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[OFFICIAL NOTICE.]

Twenty-ninth Annual Meeting, Western Gas Association.

WESTERN GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW ALBANY, IND., March 22d, 1906.

To the Members of the Western Gas Association: The Twenty-ninth annual meeting of the Western Gas Association will be held in the Hollenden House, Cleveland, O., May 16, 17 and 18, and will be called to order at 10 A.M., by the President, Mr. Paul Doty, of St. Paul, Minn.

The Hollenden is prepared to accommodate 300 guests and furnish a room suitable for the sessions of the Association and announces the following rates: European plan—Rooms with running water, $1.50 and $2; rooms with bath, $2.50, $3, $3.50 and $4; double-bedded rooms with bath, $4 to $5.

The Hollenden, while conducted on the European plan, furnishes meals as follows: Club breakfast, 50 cents and upwards; an 8-course lunch for 50, 60 and 75 cents; table d'hote dinner, 65 cents.

Insomuch as more satisfactory arrangements can be obtained by securing rooms in advance of the meeting, members are requested to do so. The following papers will be presented to the Association, together with the names of those who are to prepare discussions on the same:

"Firing of Retort Benches by Battery Producers," by Mr. Fred. Bredel, Milwaukee, Wis. Discussions prepared by Messrs. W. A. Baehr, H. B. Harrop and H. A. Carpenter.

"Electrolysis of Gas Mains," by Mr. M. R. Bump, Denver, Col. Discussions prepared by Messrs. J. D. von Maur, Bryce McAdam and C. L. Day.

"The Relation of Gas to Our Modern Lite," by Mrs. O. N. Guldlin, Fort Wayne, Ind. Discussions prepared by Messrs. J. B. Howard, J. C. D. Clarke and Irvin Butterworth.

"General Data on Artificial Gas Properties," by Mr. W. E. Steinwedell, Cleveland, O. Discussions prepared by Messrs. E. G. Cowdery, James T. Lynn and Edwin E. Witherby.

"Notes on Carbonization," by Mr. W. E. Hartman, Joliet, Ills. Discussions prepared by Messrs. O. O. Thwing, John R. Lynn and M. E. Malone.

"Regulation of Rates," by Mr. Geo. McLean, Dubuque, Ia. Discussions prepared by Messrs. M. S. Greenough, Henry L. Doherty and I. C. Copley.

"Change in Grade of Mains at Galveston," by Mr. John Gimper, Galveston, Tex. Discussions prepared by Messrs. J. H. Eustace, T. D. Miller and F. H. Shelton.

"Labor Saving Machinery for Medium Sized Retort Houses," by Mr. F. H. Shelton, Philadelphia, Pa. Discussions prepared by Messrs. Carl H. Graf, R. P. Kraft and B. O. Tippy.

"The Making of Rates and the Additional Business System of Cost," by Mr. W. H. Gardiner, Jr., Boston, Mass. Discussions prepared by Messrs. E. G. Pratt, S. J. Glass, A. P. Lathrop and H. L. Doherty.

"Some Brief Notes on Capacities of Water Gas Sets," by Mr. Rollin Norris, Philadelphia, Pa. Discussions prepared by Messrs. D. McDonald, R. E. Slade, A. F. Travis and B. E. Chollar.

"A Balance between Calorific Value and Candle Power in Water Gas," by Mr. T. D. Miller, New Orleans, La. Discussions prepared by Messrs. E. Y. Sayer, J. D. Shattuck and G. W. McKee.

"The Utilization of Tar in a Water Gas Apparatus," by Mr. Geo. H. Waring, Omaha, Neb. Discussions prepared by Messrs. W. B. Calkins, Geo. S. Clarke, V. E. Dewey and Leonard Fitzgerald.

"Water Gas Practice," by Mr. D. G. Fisher, St. Louis, Mo. Discussions prepared by Messrs. W. H. Barthold, C. H. Evans and E. E. Eysenbach.

"Extraction of Tar from Water Gas," by Mr. E. H. Earnshaw, Cincinnati, O. Discussions prepared by Messrs. H. C. Abell, H. H. Scott, R. B. Brown and V. L. Elbert.

"The Mutual Advantage to be Derived through Co-operation between Engineering Schools and Those Engaged in the Gas Business," by Prof. Chas. F. Burgess, University of Wisconsin. Discussions prepared by Messrs. A. E. Forstall, Geo. G. Ramsdell and Dr. H. B. Harrop.

"The Relations between Gas Companies and their Employees," by Mr. Joseph M. Berkley, Los Angeles, Cal. Discussions prepared by Messrs. Emerson McMillin, G. W. Clabaugh and R. M. Searle.

"Wrinkle Department," Edited by Mr. Bryce McAdam, Milwaukee, Wis. Discussions prepared by Messrs. B. W. Perkins, V. L. Elbert, Albert Kersting, S. O. Fulkerson, Chas. Forbes and James Ferrier.

"A Lecture on Industrial Betterment," by Dr. Wm. H. Tolman, New York.

"A Lecture on Engineering of Illumination," by Mr. Van Rensselaer Lansingh, New York.

It must not be inferred that discussions of papers will be limited to those whose names appear as above, for copies of all papers will be sent members in advance of the meeting, with the request that each

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come prepared to add to the general fund of information. And it is hoped that each member will consider it a duty to do so.

Papers will not be read in their entirety, but 5 minutes will be allowed each author of a paper to present conclusions.

The following passenger associations have granted reduced rates on the certificate plan, of 1½ fare for the round trip, conditional on 100 railroad certificates being presented for indorsement: Central Passenger Association, Trunk Line Association, New England Passenger Association—excepting steamship lines—Southeastern Passenger Association, Southwestern Passenger Association and Western Passenger Association.

The territories embraced by the above Associations are all the States and territories in the United States east of the line of longitude that passes through Cheyenne, Wyoming, and Denver, Col., excepting the State of Ohio, where the railroad companies are charging a uniform rate of 2 cents per mile. Those who purchase tickets to Cleveland from the State of Ohio will please obtain from ticket agent a receipt for their ticket, which receipt should be handed the Secretary of the Association and will count the same as a certificate in securing the desired 100 necessary to secure the reduced rates.

Apply to the ticket agent at least 30 minutes before the departure of trains, purchase a first-class ticket to Cleveland, paying full fare for the same, receiving from the agent certificate stating that a ticket has been purchased to attend the Western Gas Association meeting in Cleveland. This certificate must be handed the Secretary of the Association, who will have the proper indorsement made by the Passenger Association representative, which, upon the payment of 25 cents to the Passenger Association representative, will entitle the holder to a one-third rate returning home. Members are especially requested not to use their mileage books, and members from Ohio to secure receipts for the purchase of their tickets, inasmuch as the larger number of certificates and receipts obtained will make it easier for the Association in the future to obtain concessions from the various Passenger Associations.

Mr. M. S. Greenough, President of the Committee of Arrangements, announces the following entertainment programme for the Western meeting:

Ladies—Wednesday evening: Illustrated lecture at the Hollenden assembly room, followed by refreshments. Thursday, A.M.: Automobile ride through parks and boulevards; tea at Euclid Club. Thursday, P.M.: Theater party.

Gentlemen—Wednesday, P.M.: Illustrated lecture at the Hollenden assembly room, followed by refreshments. Thursday, P.M.: Banquet at the Hollenden. Friday: Visit to the gas works. Tickets to the banquet, $5.

The meeting of the Board of Directors will be held at the Hollenden House, Tuesday, May 16th, at 10 A.M.

The Secretary will be pleased to furnish application blanks to those wishing to become members of the Association.

A cordial invitation is extended to members of kindred Associations to be present and take part in the discussion of papers presented.

JAS. W. DUNBAR, Secretary.

BRIEFLY TOLD.

NOTES.—

A CORRESPONDENT in Milwaukee, Wis., writing under date of the 26th ult., inclosed the following: "Col. E. G. Pratt, who retires May 1st as Vice-President and General Manager of the Milwaukee (Wis.) Gas Light Company, to take complete charge of the Detroit (Mich.) City Gas Company, was tendered a farewell dinner by the officers and heads of departments, at the Milwaukee Athletic Club, Wednesday evening. The man of honor, Col. Pratt, was presented with a heavy gold watch fob, Secretary E. Haase making the presentation speech. R. B. Brown, Chief Engineer of the Company, acted as Toastmaster, and those present were Richard Kraft, John Mason, Guy F. Gregg, W. L. Lewis, Henry Harman, Dr. H. B. Harrop, Bryce McAdam, Ross Cornish, H. C. Schaper, S. B. Watrous and F. P. Kelsey, all heads of departments in the Company."

MR. JAMES LELAND HOWARD, for many years President of the Hartford City Gas Light Company, of Hartford, Conn., died the morning of the 1st inst., in his home in that city. He was in his 88th year, having been born in Windsor, Vt., in 1818. For many years he was prominent in the business life of Hartford, in which city he became a resident in 1841.

THE Peoples Gas Light and Coke Company, of Chicago, has declared a dividend of 1¼ per cent., payable the 25th inst.

[OFFICIAL REPORT—CONTINUED FROM PAGE 756.]

TWENTY-SECOND ANNUAL MEETING, OHIO GAS LIGHT ASSOCIATION.

HELD IN CINCINNATI, O., MARCH 21, 22 AND 23, 1906.

FIRST DAY—AFTERNOON SESSION.

The President called the meeting to order pursuant to adjournment, and introduced Mr. H. L. Olds, of Lincoln, Ills., who, as Editor of the

INFORMATION BUREAU,

presented the following report:

The Bureau of Information has now passed through its second year, and while the work carried on has not been as extensive as the first year, yet enough has been done to satisfy the Editor that it is a necessary and much needed department in this progressive Association.

As the idea of a Bureau of Information is a comparatively new one many may not know just what it is supposed to accomplish. In its humble way it will endeavor to give immediate assistance, try to answer questions, solve some of the everyday difficulties, and supply all information possible. Assisting in this work are a number of co-editors to whom the various inquiries are referred. At the same time we always feel free to write to anyone in or out of the gas business from whom we can secure desired information. All kinds of inquiries have been received, some from persons wanting assistance in securing positions. We have even answered questions sent out to the Practical Class of the American Association.

We take this opportunity to thank the co-editors and all those who have so promptly and generously assisted us in the work of this Bureau. The following are some of the inquiries received:

"What proportion should be used in mixing natural gas with water gas?"

"Where should the natural gas be introduced?"

"What would be the probable effect on the candle power?"

"Would it be a profitable thing to do if natural gas could be purchased for 12 cents per 1,000 cubic feet?"

"What is the best manner of determining the amount of gas sold, checking up the amount of gas made and sold as reported at the works?"

"What is the best system of locating leaks?"

"What is the best system of accounting for gas used between dates that the meter men are taking the index of the meters?"

"What is the difference in the generator superheater and the generator retort type used for the manufacture of carburetted water gas?"

"Which is the most extensively used at the present time?"

Discussion.

The President—Do we understand that these questions are thrown out as a sample of the kind of inquiries you are called upon to answer, or for the purpose of getting answers to them at this meeting?

Mr. Olds—They have been sent to us for answer, and in most cases they have been answered, whether satisfactorily or not to the persons asking the questions I have no means of knowing.

The President—They do not seem to me to be of such difficulty as that you would want the whole Association to help you answer them.

Mr. Olds—No; but I have called to my assistance a number of the members of the Association at times in answering these questions with an effort to have the answers as complete and as accurate as possible, and to get the experience of various members on the subject.

The President—You have the Report of the Editor of the Information Bureau. Is there to be any discussion upon it?

Mr. Butterworth—I would suggest that Mr. Olds furnish briefly answers to these various questions for publication in our "Proceedings" so as to give us all the benefit of the answers to the questions.

The President—I would like to ask Mr. Olds if he has his answers in such shape so that he can do that without great difficulty?

Mr. Olds—I think so.

The President—Mr. Butterworth, do you make that in the form of a motion?

Mr. Butterworth—I will make a motion to the effect that Mr. Olds furnish the Secretary, at his early convenience for the purpose of publication in our "Proceedings," the answers briefly which he made to these inquiries. [Seconded and adopted.]

Mr. Olds then submitted to the Secretary for publication in these proceedings the following answers:

In mixing natural gas with water gas it is well to start with a mixture of about 10 per cent. natural gas. The best place to introduce

natural gas or mix it is just before it enters the distribution holder. The effect on the candle power will be to cut it down considerably.

If natural gas could be purchased at 12 cents per 1,000 it would be a profitable thing to do to mix a certain amount with the water gas.

The amount of gas sold or accounted for is the total gas accounted per the customers' meters. The amount of gas made is determined by the readings of the station meter each day corrected for temperature. The difference in the totals of the customers' meters and the amount made per the station meter is the unaccounted-for gas, or by some called the leakage.

The common method for determining leaks in the street main system is by driving a steel bar down in the main, and by carefully withdrawing the bar you leave a small hole close to the main, which will give you some idea if you are close to the leak. A gas leak indicator, manufactured by the Hohmann & Maurer Mfg. Co., Rochester, N. Y., is giving good satisfaction.

The generator-superheater type is the type of water gas apparatus most in use at the present time.

The President—The next order of business is the

REPORT OF THE BUREAU OF FORMS AND RECORDS,

which was read by the Editor (Mr. D. W. Low, of Alliance, O.) as follows:

In submitting my report as Editor of this department I am sorry to say the Book of Forms has been called for but 4 times in the past year, representing 4 different States, Massachusetts, New York, Virginia and Ohio. As to the information which the parties obtained from same, I am unable to state.

In compiling these forms, I have observed the following:

1. Companies in the most cases have not established a standard size and shape for their various records, which would facilitate the filing of the same.

2. That the records collected by the blanks of different companies are such that, to make a collective report of any 10 companies of this Association, such as made in the report of the Massachusetts Board of Gas and Electric Light Commissioners, would be impossible.

3. That, with a great many companies, the reports are misleading. If those who do not keep a connected record would go over their system, they would not quote so readily the wonderful results they are getting. Take the manufacturing records: How many keep record of the unaccounted-for coal, oil, etc.? What becomes of the extra shovel of coal thrown on after scales balance, "for luck?" Why is it that so many of these companies that get such wonderful yields do not declare big dividends?

What are the records we want? We buy $1,000 worth of gas in the form of coal. How much we sell to our customers, and at what cost, are the records we are after. We may subdivide this into:

Results obtained and cost at works.
" " " " retorts.
" " " in holder.
" " " at customer's meter.
" " " " customer's burner.

We must still keep track of the total. Why should we take the result between the retort and holder, and pride ourselves on the result? Does it pay dividends? If you feel that you cannot keep an elaborate record, then start with two records: Amount of gas bought in coal; amount of gas sold by consumer's meter.

There is no danger if you start with these two records of your being misled, for you will, at the end of the first month, want to know what has happened between the coal bought and gas sold. You will not be satisfied with a report which shows you that your stoker weighed so much coal, and your station meter records shows you have put into the holder so many feet of gas.

What is the true cost per 1,000 of gas? Is it not the total expense divided by gas sold as recorded by customer's meter? We have our station meter as a check between the manufacturing cost and distribution cost, but it does not give us our selling cost. Why mislead ourselves with an elaborate system of records, which does not tell us what we ought to know?

If, then, the first month you have decided that you want to know what is going on between the buying and selling cost, and start to get up a system of records and forms, remember that your stoker and meter men are not bookkeepers or clerks, so make your blanks as complete as possible, leaving but little for them to fill out.

The classification and distribution of accounts is a very vital part in arriving at our true cost. Many who are operating combination plants are at a loss to figure out a scheme whereby they can make the classification of accounts conform to the standard systems adopted by the American Gas Light Association, the National Electric Light Association, and the American Street Railway Association.

I will give you the classification I have used, and am trying to perfect, using a system of numbering whereby the number itself explains to what account and sub-account the item is chargeable. This system applies to the old distribution and analyzing of cost. Now that the 2-rate system of charging is gradually coming into use, and already adopted in the larger plants of electric light, and being agitated in the gas, I should like to make a classification of cost conform to same by making 1,000 construction expense, 2,000 standing or fixed expense, and 3,000 operating or running expense. This can only be done by the assistance of the larger plants. The following classification will give you some idea of the system I am using:

1,000 Accounts chargeable to construction.
2,000 " " maintenance, or repairs and renewals.
3,000 " " operating.
4,000
5,000 " " income or earnings.

The above accounts are sub-divided into the following:

100 General.	600 Electric light distribution.
200 Electric light station.	700 Gas distribution.
300 Gas works.	800 Street railway distribution.
400 Street railway power house.	900 Miscellaneous.
500 Steam heat in plant.	

To illustrate the use of this system. Take a bill for new gas meters the number 1,700 written on bill would signify to the bookkeeper that it would be charged to construction, gas distribution.

If it was for repairs of meters 2,700 would signify maintenance gas distribution. If it was setting and removing meters the number would be 3,700 or operating distribution.

The following classification gives a still further distribution:

70 is for meters.
1770 is construction, gas distribution meters (meter account)
2770 is maintenance " " " (B—6)
3770 is operation " " " (B—7)

If it was electric meters everything would be the same, except 600 electric distribution in place of 700 gas distribution. A still further distribution as 2,771 would show that it was labor in repairing meters.

I believe this distribution shows up best in the distribution of time for payroll, posting a number for each sub-division of work, and with instructions that 100 represent the department, and 1,000 classification of work, new, repairs or operating. In giving numbers to different accounts, I have tried to maintain some number for same or similar items of the different systems. For example: Boiler, boiler fuel, and arc lamps are No. 20; water power, water gas, and sub-stations are No. 50.

It was impossible to carry this out throughout the whole system. For example, I was obliged to give 70 for meters in gas and electric distribution, and to conductors in street railway distribution. In the distribution of general expense, I believe it better in small combination plants to charge all accounts under one head, dividing it afterwards in proportion to amount of business done in each department. The following give my sub-accounts conforming to the three standard classifications:

Classification of the Three Standard Systems.

My No.	Electric Light. 200	Gas. 300	Street Railway. 400
		MANUFACTURING.	
3210	(1) Power plant wages		
3310		(A-7) Manufacturing labor	
3410			(10) Power plant wages.
3220	(2) Fuel for power		
3320		(A-1) Boiler fuel	
3420			(11) Fuel for power.
3230	(3) Water for power		
3330		(A-14) Water tax	
3430			(12) Water for power.
3240	(4) Oil and waste		
3340		(A-4) Fuel under retorts—2	
3340		(A-6) Gas coal—4	
3340		(A-2) Enrich. gas—5	
3440			(15) Oil and waste.
3250	Water power		
3350		(A-5) Gen. fuel—2	

Classification of the Three Standard Systems—Continued.

My No.	Electric Light. 200	Gas. 300	Street Railway. 400
		MANUFACTURING.	
3350		(A-8) Gas oil–5	
3450			
3260	(6) Hired power		
3360			
3460			(15) Hired power.
3270			
3370		(A-9) Purifying labor–1	
3370		(A-10) Purifying supplies–7	
3470			
3280	(7)		
3380		(16) Coke exp.–2	
3380		(17) Tar exp.–3	
3380		(15) Ammo. exp.–4	
3480			
3290	(5) Miscellaneous		
3390		(A-3) Exp. works	
3490			(14) Miscel. expense.
		MAINTENANCE.	
2210	(12) Bdgs. and fixtures		
2310		(A-11) Repair wrks	
2410			(3) Bldgs. and fixtures.
2220	(8) Boilers		
2320		(A-11)	
2420			(4) Steam plant.
2230	(11) Miscel. equipment.		
2330		(A-11)	
2430			(4)
2240	(9) Engines		
2340		(A-12) Coal gas works	
2440			(4)
2250	(13) Dams, canals, etc.		
2250	(14) Gates, wheels, etc.		
2350		(A-13) Water gas works	
2450			(4)
2260			
2360			
2460			
2270	(10) Electric plant		
2370			
2470			(5) Electric plant.
2280	(15)		
2380			
2480			
2290			
2390			
2490			

My No.	Electric Light. 600	Gas. 700	Street Railway. 800
		DISTRIBUTION. *Operating.*	
3610			
3710			
3810			(23) Cleaning and sanding.
3620	(16) Arc lamps	(G) Street lamps	
3720			
3820			(24) Snow and ice.
3630			
3730			
3830			(16) Supt. transportation
3640			
3740			
3840			(21) Car service supplies.
3650	(19) Sub-station		
3750			
3850			
3660	(21)		
3760			
3860			(20) Car house empl.
3670	(17) Meters		
3770		(B-7) Set and remove meters	
3870			(17) Conductors.
3680	(18) Renewal inc. lamps		
3780		(B-1) Complaint ex.	
3880			(18) Motormen.
3690	(20) Miscellaneous		
3790		(B-3) Gratuitous work	
3890			(22) Mis. car service ex. (19) Other car service.

Classification of the Three Standard Systems—Continued.

	Electric Light.	Gas.	Street Railway.
		DISTRIBUTION. *Maintenance.*	
2610	(22) Underground sys.		
2710		(B-4) Repair mains	
2710		(B 8) Street mains abandoned	
2810			(1) Track and roadway.
2620	(24) Arc lamps		
2720		(G) Street lamps	
2820			
2630	(23) Overhead system		
2730			
2830			(2) Overhead elec. line.
2640			
2740		(B-5) Repair services	
2840			
2650	(27) Sub-station		
2750			
2850			
2660	(28)		
2760			
2860			Car barns.
2860			(9) Shop expense.
2670	(25) Meters		
2770		(B-6) Repairing meters	(6) Cars.
2870			
2680	(26) Customers rep. r.		
2780			(7) Elec. equip. cars.
2880			
2690			
2790			(8) Miscel. equipment.
2890			
		GENERAL EXPENSE.	
2100			
2110	(29) Salary general offices	(D-8) Salary gen.	(25) Salary gen. offices.
2120			
2130			
2140			
2150			
2160			
2170	Discount	Discount	Discount.
2180		(9) Uncol'ted bills.	
2190	(34) Miscel. gen. exp.	(3) Expense, gen.	(32) Miscel. general exp.
2910	(34) Damages	(1) Damages and accident	(33) Damages.
2920			(34) Legal expense.
2930		(2) Association meeting	
2940		Bond interest	
2950		Other interest	
2960	(38) Tax	Tax	(39) Tax.
2970	(37) Insurance	(5) Insurance	(38) Insurance.
2980	(35) Legal expense	(7) Litigation	(35) Other legal exp.
2990		(4) Exp. extraord'y	
		COMMER. EXPENSE.	
3100			
3110	(30) Salary, clerks	(3) Office salary	(26) Salary, clerks.
3120		(2) Office expenses.	
3130		Office expenses	
3140	(31) Ptg. and stationery	Office expenses	(27) Ptg. and stationery.
3150		Office expenses	(30) Stable expense.
3160	Rent	Office expenses	Rent.
3170		Office expenses	
3180	Collecting	(C-1) Collecting	
3190		(B-2) Dist. office ex	(28) Miscel. office exp.
		NEW BUSINESS.	
3900			
3910	(33) Soliciting	(3) Exp. soliciting.	
3920	(32) Electric supplies		
3930		(4) Gas appliances.	
3940	(33) Advertising	(1) Advertising	(31) Advertising.
3950		(2) Demonstrations	(31) Attractions.
3960	(32) Electric meters		
3970		(5) Gas stoves and engines	
3980			(29) Storeroom expense.
3990	Miscellaneous	Miscellaneous	Miscellaneous.
		CONSTRUCTION OF PLANT INVESTMENT.	
1110	(A) Organization		(A) Organization.
1210	(C) Real estate		
1310		Real estate	
1410			(F) Real estate.
1410			(G) Building.
1610	(I) St. installation		
1710		Mains	
1810			(C) Right of way.

Classification of the Three Standard Systems—Continued.

	Electric Light.	Gas.	Street Railway.
		CONSTRUCTION OF PLANT INVESTMENT.	
1910			
1120			(B) Eng. and Supt.
1220	(E) Steam plant		
1320			
1420			(1) Power plant.
1620	(J) Arc lamps		
1720		Street lamps	
1820			(D) Track and roadway
1920			
1130	(B) Royalty and license		
1230			
1330			
1430			
1630	(H) St. installation overhead		
1730			
1830			(E) Electric line.
1930			
1140	(L) Tools and instruments		
1240			
1340			
1440			
1640	(H) Services		
1740		Sesvices	
1840			
1940			
1150			(N) Int. and discount.
1250	(D) Water power plant		
1350			
1450			
1650	(G) Sub-station		
1750			
1850			
1950			
1160	(M) Office fur. and fix.		
1260			
1360			
1460			
1660			
1760			
1860			(J) Shop tools, mach.
1960			
1170			
1270	(F) Generating equip.		
1370			
1470			
1670	(K) Meters		
1770		Meters	(K) Cars.
1870			

Classification of the Three Standard Systems—Continued.

	Electric Light.	Gas.	Street Railway.
1970			
1180			
1280			
1380			
1480			
1580			
1680			
1780			
1880			(L) Elec. equip. cars.
1190			(H) Real estate invest.
1290			
1390			
1490			(O) Miscellaneous.
1690			
1790		Extensions.	
1890			(M) Miscel. equipment.
1990			

These accounts are still further divided into:

1. Labor.	4. Supplies.	7. Supplies.
2. Supplies.	5. "	8. "
3. "	6. "	9. Expense.

Maintaining 1 and 9 to be the same throughout the whole system, it gives seven sub-divisions for each account, as in coal gas works, water gas works, purifying and by-product, I was obliged to use the numbers as follows:

3340.	3350.	3370.	3380.
1.	1.	1. Purify'g labor	1.
2. Bench fuel	2. Generat'r fuel	2.	2. Coke exp.
3.	3.	3.	3. Tar exp.
4. Gas coal	4.	4.	4. Ammonia exp
5. Enricher gas	5. Gas oil	5.	5.
6.	6.	6.	6.
7.	7.	7. Supplies	7.
8.	8.	8.	8.
9. Expense	9. Expense	9. Expense	9. Expense

I have still carried the classification under common number, for example, 20 is fuel. I have maintained 2 as fuel; 300 is gas works, and tar is by-product sf the gas works; I have made that 3. Ammonia is a by-product of coal gas works, which is 40. I have made ammonia, 4.

The following is a voucher which we are using, and I have placed the letter or number used by the three standard systems of accounts:

Department.			Account No.								
No	Amount.		10	20	30	40	50	60	70	80	90
0000											
1100	General	Construction.	-A-A-	-B-	-B-	-L-	-N-	-M-	-F-		-H-
1200	Elec. works		-C-	-E-			-D-				
1300	Gas works		Real estate								
1400	St. R. R. works		F-	-I-							-O-
1500			G-								
1600	Elec. district		-I-	-J-	-H-	-H-	-G-	-K-			
1700	Gas district		Mains	St. lamps		Services		Meters			
1800	St. R. R. district		C-	D	-E-			-J-	K	L	M
1900	Miscellaneous										
2100	General	Maintenance.	-29-D8-25							9-	34-3-32
2200	Elec. works		12-	-8-	-11-	-9-	-13-14-		-10-	-15-	
2300	Gas works		-A11-	-A11-	-A11-	-A12-	-A13-				
2400	St. R. R. works		-3-	-4-	-4-	-4-			-5-		
2500											
2600	Elec. district		-22-	-24-	-23-		-27-	-28-	-25-	-26-	
2700	Gas district		-B4-B8-	-G-		-B5-			-B6-		
2800	St. R. R. district		-1-		-2-			-9-	-6-	-7-	-8-
2900	General		-33-1-33	-34-	-2-			-38-39-	37-5-38	-35-7-35	-4-
3100	Commercial		-30-3-26	-2-	-2-	-2-31-27	-2-30	-2-	-2-	-C1-	-B2-28-
3200	Elec. works		-1-	-2-	-3-	-4-		-6-		-7-	-5-
3300	Gas works		-A7-	-A1-	-A14-	-A4-6-2-			-A9-10	-A15-16-17	-A3-
3400	St. R. R. works	Operating.	-10-	-11-	-12-	-15-		-15-			-14-
3500											
3600	Elec. district			-16-			-19-	-21-	-17-	-18-	-20-
3700	Gas district								-B7-	-B1-	-B3-
3800	St. R. R. district		-23-	-24-	-16-	-21-		-20-	-17-	-18-	-19-22-
3900	New business		-33-3-	-32-	-4-	-33-1-31	-2-31-	-32-	-5-	-29-	

The following is the classification of accounts as given by the Street Railway Accounting Association as their standard classification, the American Gas Light Association, and the National Electric Light Association as their standard classification. I have placed in front of each item the number corresponding to mine. Where I have been obliged to sub-divide to the unit number, I put the number after the wording.

UNIFORM SYSTEM OF ACCOUNTS OF THE NATIONAL ELECTRIC LIGHT ASSOCIATION.—LIST OF CONSTRUCTION ACCOUNTS.

1110 A. Organization.
1130 B. Royalties.
1130 Franchise.
1130 License.
1210 C. Real estate.
1210 Buildings.
1250 D. Water power plant.
1220 E. Steam plant.
1270 F. Electrical generating plant.
1650 G. Sub-station installation.
1650 Storage battery.
1650 Rotary transformers, etc.
1630 H. Street installation (overhead).
1640 Service installation (overhead).
1610 I. Street installation (underground).
Service installation (underground).
1620 J. Arc light installation.
1670 K. Meter.
1670 Meter appliances.
1670 Line transformer installations.
1140 L. Tools.
Instruments.
1160 M. Office furniture.
Office fixtures.
N. (To be reserved for future use.)

LIST OF EXPENSE ACCOUNTS.—COST OF MANUFACTURE (GENERATING).

Operating.

3210 (1.) Power plant wages.
3220 (2.) Fuel for power.
3230 (3.) Water for power.
3240 (4.) Lubricants and waste for power plant.
3200 (5.) Miscellaneous supplies for power plant.
3290 Miscellaneous expenses for power plant.
3260 (6.) Hired power.
3280 (7.) (To be reserved for future development.)

Maintenance.

2220 (8.) Maintenance of boilers.
2240 (9.) " of engines.
2270 (10.) " of electric plant.
2230 (11.) " miscellaneous station equipment.
2210 (12.) " buildings.
2210 " fixtures.
2250 (13.) " dams.
2250 " canals.
2250 " tail races.
2250 (14.) " of gates.
2250 " of wheels.
2250 " of governors.
2280 (15.) (To be reserved for future development.)

COST OF DISTRIBUTION.

Operating.

3620 (16.) Operating arc lamps.
3670 (17.) " meters.
3680 (18.) Renewal of incandescent lamps.
3650 (19.) Operating sub-stations.
3690 (20.) Miscellaneous distribution operating expenses.
3660 (21.) (To be reserved for future development.)

Maintenance.

2610 (22.) Maintenance underground system.
2630 (23.) " overhead system.
2620 (24.) " arc lamps.
2670 (25.) " of meters.
2680 (26.) Customers' repairs and renewals.
2650 (27.) Maintenance of sub-stations.
2660 (28.) (To be reserved for future development.)

General Expense.

2110 (29.) Salaries of general officers.
3110 (30.) " clerks.
3140 (31.) Printing and stationery.
3920 (32.) Store room expense.
3940 (33.) Advertising, canvassing and soliciting.
2190 (34.) Miscellaneous general expense and office sundries.
2980 (35.) Legal expense and loss and damage.
3160 (36.) Rents.
2970 (37.) Insurance.
2960 (38.) Taxes.
39 (To be reserved for future development.)

UNIFORM SYSTEM OF ACCOUNTS FOR GAS COMPANIES.—LIST OF CONSTRUCTION ACCOUNTS.

1310 Plant.
1310 Real estate.
1710 Extension of street mains.
1790 Extension and improvements.
1710 Street main improvements.
1720 Street lamp extension.
1770 Meters.
1740 Services.
1710 Extension of mains,.....Inch.

OPERATING ACCOUNTS.

A—Manufacturing.

3320 (1.) Boiler fuel.
3340 (2.) Enricher coal gas.
3390 (3.) Expense works.
3340 (4.) Fuel under retorts.
3350 (5.) Generator fuel.
3340 (6.) Gas coal.
3310 (7.) Manufacturing labor.
3350 (8.) Oil (water gas).
3370 (9.) Purification labor.
3370 (10.) " supplies.
2310 (11.) Repairs works general.
2340 (12.) " coal gas.
2350 (13.) " water gas.
3330 (14.) Water tax.
3280 (15.) Ammoniacal liquor expense.
3280 (16.) Coke expense.
3280 (17.) Tar expense.

B—Distribution.

3780 (1.) Complaint expense.
3190 (2.) Distribution office expense.
3790 (3.) Gratuitous work.
2710 (4.) Repairs mains.
2740 (5.) " services.
2770 (6.) Repairs, meters.
3770 (7.) Setting and removing meters.
2710 (8.) Street mains abandoned.

C—Commercial Expense.

3180 (1.) Expense collection.
3120 (2.) " office.
3110 (3.) Office salaries.

D—Expense.

2910 (1.) Accidents and damages.
2930 (2.) Association meetings.
2190 (3.) Expense general.
2990 (4.) " extraordinary.
2970 (5.) Insurance.
2950 (6.) Interest.
2980 (7.) Litigation.
2110 (8.) Salaries general.
2980 (9.) Uncollectible bills.

E—New Business.

3940 (1.) Advertising.
3930 (2.) Appliance demonstrations.
3910 (3.) Expense soliciting.
3930 (4.) Gas appliances.
3970 (5.) Gas engine expense.
3990 (6.) House fitting expense.
2960 F—Taxes.

3720 G—Street lamp operating.
2720 " "
2170 H—Discount.

REPORT ON STANDARD SYSTEM OF STREET RAILWAY ACCOUNTING.—CONSTRUCTION AND EQUIPMENT ACCOUNTS.

1110 A. Organization.
1120 B. Engineering and superintendence.
1810 C. Right of way.
1820 D. Track and roadway construction.
1830 E. Electric line construction.
1410 F. Real estate used in operation of road.
1410 G. Buildings and fixtures used in operation of road.
1910 H. Investment real estate.
1420 I. Power plant equipment.
1860 J. Shop tools and machinery.
1870 K. Cars.
1880 L. Electric equipment of cars.
1890 M. Miscellaneous equipment.
1150 N. Interest and discount.
1490 O. Miscellaneous.

OPERATING EXPENSE ACCOUNTS.—MAINTENANCE.

Way and Structures.

2810 (1.) Maintenance of track and roadway.
2830 (2.) " electric line.
2410 (3.) " buildings and fixtures.

Equipment.

2420 (4.) Maintenance of steam plant.
2470 (5.) " electric plant.
2870 (6.) " cars.
2880 (7.) " electric equipment of cars.
2890 (8.) " miscellaneous equipment.
2860 (9.) Miscellaneous shop expense.

TRANSPORTATION.

Operation of Power Plant.

3410 (10.) Power plant wages.
3420 (11.) Fuel for power.
3430 (12.) Water for power.
3440 (13.) Lubricants and water for power plant.
3490 (14.) Miscellaneous supplies and expenses of power plant.
3460 (15) Hired power.

Car Service.

3830 (16.) Superintendence of transportation.
3870 (17.) Wages of conductors.
3880 (18.) " motormen.
3891 (19.) " other car service employees.
3860 (20.) " car house employees.
3840 (21.) Car service supplies.
3892 (22.) Miscellaneous car service expense.
3810 (23) Cleaning and sanding track.
3820 (24.) Removal of snow and ice.

General.

2110 (25.) Salaries of general officers.
3110 (26.) " clerks.
3140 (27.) Printing and stationery.
3190 (28.) Miscellaneous office expense.
3980 (29.) Store room expense.
3150 30. Stable expense.
3140 (31.) Advertising and attractions.
2190 (32.) Miscellaneous general expenses.
2910 (33.) Damages.
2920 (34.) Legal expenses in connection with damages.
2980 (35.) Other legal expenses.
3160 36. Rent of land and buildings.
3160 37. Rent of tracks and terminals.
2970 (38) Insurance.
2960 (39.) Taxes.

Discussion.

The President—Gentlemen, you have heard this very interesting report of the Bureau of Forms and Records. I would like to have a full discussion of it.

Mr. Gardiner—This paper brings to mind the basic question of how we shall figure costs. As I understand it, in glancing over the paper, and hearing it read but once, the division contemplates dividing the costs essentially on the present basic system of works, or manufacturing expense in its various details, then distribution expense, management expense, taxes, incidentals, etc., making the total operating expense. Beyond total operating expense, such items as interest, dividends, balance to profit or loss, etc., appear. That is essentially the system as used in the Massachusetts Commissioners' Reports. It seems to me, although I hesitate to say so, that this system is fundamentally wrong from the point of view of ascertaining true cost. I take the cost of a commodity, whether it is gas or electricity or shoes or anything else, is the total of the manufacturing expense plus the current charges on the investment necessary to furnish the equipment to produce that article; and interest, taxes, depreciation, insurance, etc., on the investment necessary to the equipment to produce the given result—be it gas or shoes—is just as much a part of the cost and is just as vital an item of cost as the coal bill or the payroll or any other of the various items of manufacturing expense and should be carried in such way as to show (for the management at any rate) the total cost. Take, for instance, in the manufacture of gas. I have in mind a certain consolidation of accounts covering a large number of companies in which, if I remember rightly, the manufacturing expense amounted to about 60 cents per 1,000 cubic feet. The distribution expense amounted to something like 11 cents through the expense accounts. In revising those figures, according to the system which I use personally, I first apportioned to the manufacturing department all of the assets of the manufacturing department. I took a certain amount of real estate which is used for the purpose of manufacturing, as for example, so many thousand dollars. I took the machinery at so many thousand dollars used in the manufacture of gas. I took the appliances at so many thousand dollars, and the tools, etc., in the manufacturing department, and so many thousand dollars for materials on hand in the manufacturing department. Against each one of these items I charged the taxes caused by their existence. I charged insurance and a basic rate of interest against each one of these items. I charged the amount of depreciation annually occuring in each one of these items. The total of these charges added to the manufacturing expense it seems give me, and indeed only by so totalling it do I get at the real total cost of the gas in the holder. Therefore, it seems to me that any accounting system, to be accurate, should take these items into consideration. Another point of view which I would like to take this opportunity to present is that our interest on investment is always, by the socialistic portion of the community, and frequently by others, claimed as profit. It is not profit at all. It is just as much a part of the cost as is the coal bill—I mean the basic interest. It seems to me we should keep our accounts in such manner as to show it as such instead of flattering ourselves that we are making gas at a much less rate than we are in fact making it. We may say, for instance, that the total burner cost is 80 or 90 cents, and anything over and above that is profit on the capital investment. It is not. It is cost, or a large part of it may be cost. Now, as to the actual results in figuring the accounts as I have suggested, certain manufacturing expenses showed up as 60 cents. Figuring the charges into that manufacturing department as I do, it raised the holder cost of gas to 80 cents in round numbers. Take the distribution at, I think, 11 cents. The charges on the distribution department in taxes, interest, depreciation, etc., on the equipment and distribution department, practically double the real cost of distribution. The same was true of the expenses of management. We have certain expenses in the management, but many of the costs of management are overlooked in the figuring of costs. For instance, we have our rentals, office expense, building, etc. Among other things in the conduct of the business we must have a large amount of working capital on hand. Interest on this is a part of the management cost. Adding these charges to the management expense practically doubled the management expense. Of course, the items of taxes, insurance and incidentals are wiped out as separate items for they are apportioned among the other three items of the business, so that the results thus figured will show the real total cost in each department, and whatever balance or deficit there may be is the true net earning or net loss on the year's business. In figuring costs, therefore, I should say that I personally always figure, as a legitimate and necessary part of the cost, all the current, basic charges on the equipment necessary to the conduct of the business in each given department. It seems to me that that is the only correct way to figure costs, and, therefore, that any accounting system should contemplate carrying these items forward as I have suggested rather than carrying them as expenses first and charges afterwards.

The President—Gentlemen, although the idea Mr. Gardiner advances is rather a novel one, it seems to me to be an exactly accurate one, and

what is very important is that it would do away with the idea that gas is put in the holder at 5 cents which, in order to get it into the holder at that price, you must fail to charge interest and depreciation on property representing a half a million of the capital. I would like to hear a full discussion on this subject and I hope the members will carry it forward. Mr. Thwing, we would be glad to hear from you on this subject.

Mr. Thwing—Mr. President, I have not had time to look over this paper and it is rather hard to discuss a paper intelligently, only having read it once. It occurred to me while this report was being made that one very valuable account had been overlooked, a contingent account to which articles may be charged off month by month during the year, such as benches, or repairs of benches, etc., and then prorated throughout the year.

The President—As Mr. Gardiner said, a great deal of capital is made by men advocating municipal ownership and socialistic confiscation at the very low figure at which gas can be made, figuring accounts as has been suggested, and those figures are invariably arrived at by failing entirely to charge against the holder cost either interest, depreciation or taxes on the plant with which the gas is made, and it would seem to me a better protection to the gas company if such items were put into the manufacturing account to begin with, where they seem to belong. Mr. Butterworth, we would like to hear from you on this paper.

Mr. Butterworth—I have nothing special to suggest, Mr. President. Mr. Doty is our expert.

Mr. Whysall—I would like to ask Mr. Gardiner whether he is handling his accounts in that manner or whether that is simply his personal view. I had a little experience along that line. I took care of the accounts just as Mr. Gardiner has suggested precisely, but a firm of accountants came along to go through the outfit and the accountant in about 2 minutes reduced the price of gas 11 or 12 cents a 1,000. I think all these items should be taken into account, but on the other hand, it largely depends upon the financial condition of the company whose accounts are under consideration; whether you are buying or selling for instance. Now, it is perfectly proper to get the interest on the money invested some place—to get it in somewhere; but under the varying conditions of different companies it might be difficult to advocate a universal or uniform method.

Mr. Gardiner—To answer Mr. Whysall I would like to say that the system which I have just outlined is entirely personal. I do not know of any company that carries that system in detail into its accounts. As far as the ordinary book accounts go, I think the accounts should be kept in whatever manner the final body, be it the Board of Directors, the Gas Commission, or what not, wishes to receive them. But entirely apart from that, I believe in keeping the accounts in such manner as will show the management at all times the true condition of affairs, whether profiable or unprofitable or otherwise. What the management wants to know is the truth, and it seems to me fundamentally true that the management of a given company, for instance, cannot know the fundamental truth as to the cost of gas in the holder if it leaves out of consideration the current annual charges on the investment required by the equipment to put the gas into that holder. Therefore, it seems from the point of view of the management—I am not speaking from the point of view of the outsider, but from that of the detailed management of the concern—these charges should certainly appear in the accounts as suggested to arrive at the true cost of gas in the holder. The various items which I have suggested should be charged against the cost of gas in the holder, the cost of distribution and the expense of management. Furthermore, if we accustom ourselves to accounting by that method we would, in ourselves and in others, it seems to me, develop a much more accurate knowledge of costs which would have a tendency to overcome some of the difficulties referred to. I have had occasion in the last few months to review the costs of a very great many municipal enterprises. I had to make reports on many of these municipal enterprises—gas, electric and traction—in England, and a very great many municipal enterprises in gas and in electricity in this country. I have invariably found that charges were not properly made under the system of accounting they use. It seems to me that with the system I suggest it would be almost impossible to avoid some range of proper charges, and, therefore, I advocate some such system as would show the management of the business the true condition of affairs. If they get those facts before them, then if they desire they can turn back to the system followed by the Massachusetts Gas Commission as to interest, depreciation, dividends and balance, if any, if they want to; but what I am driving at is to furnish to the management that information which will demonstrate to them what the gas really costs. They should know what it actually costs to manufacture gas. I have even considered the propriety in a large company of dividing the departments of manufacture, distribution and management essentially as three separate concerns, so that the manufacturing department, with its various investments, etc., should manufacture and sell the gas at the governor to the distribution department, which would then take the gas and deliver it at the inlet of the customer's meter to the management, and the management would then buy it of the distribution department and handle it from the inlet of the meter until the return for the gas finds its way into the treasury of the company. In that way, for instance, one item to be taken into consideration would be the gas unaccounted-for, which is a cost of distribution. That would be one of the expenses of the distribution department. It receives so much gas at the outlet of the governor and the gas at the inlet of the governor costs so much. The company delivers that gas to the customer's meter, but it has lost a certain amount, and in proper bookkeeping it pays for it as a part of the total cost of the manufacture and distribution of the company's product.

The President—Mr. Doty, you were hidden behind the flowers so that I could not see you, and I am sure we would all like very much to hear from you on this subject.

Mr. Doty—I do not care to say anything about it, Mr. President.

Mr. Forstall—I have been waiting to have the President call on me for some time, but as he has not seen fit to do so, my modesty impels me to address myself to this subject anyway. What Mr. Gardiner proposes, it seems to me, is merely putting on the general books of the company those facts in regard to the manufacture and distribution of gas, for instance, which every engineer must have in order to be able to compare the ultimate advantages of different kinds of machinery and different methods for doing the work. Unless we take into account the depreciation and interest charges, we cannot tell whether we are doing our work more cheaply after we put in a whole lot of expensive machinery than we did it before we put in the machinery, unless there is some such division of accounts, and I think that is a point lost sight of very often in getting at the advantages of machinery. A favorite expression among Englishmen is "The shovel takes a great deal of beating," and I think we often make a mistake in not taking into account depreciation on machinery and other items of legitimate charges against investment account. So that the idea is to get generally on the books of the company just what every engineer has to do for himself as the accounts are now kept. In that respect it would be quite an important thing if we could get accountants to see the importance of this subject as we see it. Another point I would like to bring out is that if you have a system of accounts, no matter how perfectly you have gotten them arranged, if there is not some outside person who is going to look over those accounts and audit them the chances are that the accounts will not show what they are supposed to show. There are a great many different ways of beating classifications unless there is a disinterested outside person to see to it that it is not done. It is often done unintentionally. The reports, for instance, to the Massachusetts State Commission are supposed to be comparable between different companies, but anybody who looks into it will find that they are far from being comparable.

The President—I infer that Mr. Forstall came very near not saying anything because I did not call on him. I do not want any other "Light hidden under that bushel." I hope you will all talk, if you are interested in this subject.

Mr. Low—In reply to Mr. Gardener's remarks I desire simply to say that I have not in any way assumed to open up any new accounts. What I had reported is simply the classification of the 3 standard systems in this country, namely, those of the American Street Railway Association, the National Electric Association and the American Gas Light Association. Those are the 3 classifications that are collected together, and it is on those classifications that I have formulated this report. It is following out Dewey's system of indexing catalogues. It was not intended to be a discussion of the subject as to whether there should be new accounts opened up, but was simply a classification of the accounts as indicated, by number.

The President—The key of it is that the number tells you what the account is, and the account tells you what the number probably is.

Mr. Low—Yes.

The President—It seems a very ingenious plan.

It was then moved by Mr. Gardiner, seconded and carried, that a vote of thanks be extended to Mr. Low for the interesting and valuable contribution which he made to gas literature.

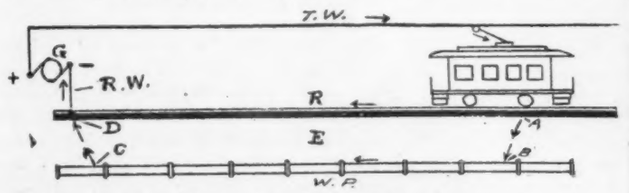
(To be Continued.)

[Communicated.]

Electrolysis: General Electrical and Lightning Protection.

By H. W. Spang.

It is evident from the improper methods and means employed for preventing the electric destruction of water and gas pipes and other underground metal structures that electric engineers are still baffled as to this problem. This is due to the fact that, although the earth has been used since 1838 for electric circuit purposes, the true action of electricity, and especially a power current, in connection with the earth is generally unknown. The great difference between a ground circuit and a shunt circuit is also generally unknown. Electric engineers have apparently been unable to determine the true action of the trolley railway current in connection with the underground metal pipes, etc., and the earth, although such action has been clearly indicated during the past 15 years. With the first electric railways installed in this country, the current was expected to confine itself to the metallic circuit consisting of the overhead trolley wire, car circuit, bonded track rails, *R*, and the return wire, *R W*, as shown in the accompanying illustration. Underground electric destruction was first manifest d in



Supposed Shunt Path of Trolley Railway Current.

this country during 1891 and 1892 in connection with the lead sheaths of underground telephone wires and service water and gas pipes adjacent to the point, *D*, where the negative pole of current generator, *G*, is connected with the track rails. During 1893 the theory was advanced that, owing to defective bonding of the track rails, the current was compelled to leave the rails and to return to the generator via the shunt circuit, consisting of the parallel water or other metal pipe, *W P*, and the earth, *E*, intervening, between *A* and *B*, also between *C* and *D*. It is a ridiculous theory, and its fallacy was first clearly indicated in Brooklyn during 1894 about the Fulton Ferry, and since then in many other cities, by the underground electric destruction, at points from 1 to 10 miles or more distant from power stations, and also from about 100 feet to a mile or more distant from the nearest electric railways. The said theory has caused a useless expenditure of money to be made by electric railway companies during the past 10 years for various means which have failed to prevent underground electric destruction.

As the shunt path, consisting of the parallel metal pipe *W P*, and the earth between *A* and *B*, also between *C* and *D*, is of much greater resistance than the bonded track rails *R*, even if a number of the rail bonds thereof are broken or defective, there is no reason why sufficient current should flow over such shunt path and damage the parallel metal pipe *W P* along its entire length. I have yet to hear of the first authentic case where a water or other metal pipe, parallel with a trolley railway for half a mile or more, has been destroyed by the trolley current flowing over such a shunt path. During 1890 I discovered the great attraction of the trolley railway current for well saturated earth, and in order to utilize such earth in a ground circuit it will flow a long distance over intervening underground metal pipes and the sheaths of underground electrical wires, even if metallically separated from each other. Co-incident with the electrification of the old railroad between Prospect Park, Brooklyn, and Coney Island during that year, the operation of the ocean cable of the Commercial Cable Company was disturbed. The said cable terminates at Manhattan Beach and its land cable was then underground along Ocean avenue, parallel with the said railroad, but about half a mile distant therefrom. The trolley railway current from positive pole of generator after traversing the car motors flowed from the track rails over the adjacent earth to the nearest underground metal pipe, thence eastward to Ocean avenue and across the intervening earth to the metal sheath of the said land cable, thence southward to Sheepshead Bay, adjacent to which electric pitting of an iron tube which inclosed said cable was afterward manifested.

Since then, many cases have been manifested in this country in which 4, 6, 8 and 12 inch water mains have been electrically destroyed at points adjacent to waterways and swamps, after being subjected to the flow of currents from adjacent trolley railways, for periods varying from 5 to 12 years. This is the worst phase of underground electric destruction, for the reason that water can escape undetected for years from the pitted mains into such waterways, etc.

In some cases the current flows from electric railways to well saturated earth via two or more metal pipes, conveying water, illuminating or natural gas, oil, brine, etc., although metallically separated from each other. As the total length of the earth intervening between such separated pipes varies from 4 to 6 feet, it is obvious that insulating joints in a water or gas pipe, similarly located, offer but little impediment to the flow of the current to well saturated earth, and hence electric pitting is caused with such metal pipe about such joints. The first line of water main badly pitted about its joints was at Peoria, Ills. It consisted of about 500 feet of 16-inch cast iron pipe located between an electric railway and a filtering bed along the Illinois river and about 2 miles distant from the power station, and was rendered useless after being subjected to the trolley railway current for about 10 years.

One of the gas wells upon the property of the Westinghouse Machine Company, at East Pittsburgh, Pa., was put in use in 1903. It consisted of 2-inch steel tubing, about 2,000 feet in length, within a 6-inch metal casing of about the same length. At about 1,800 feet rubber packing is employed between the tubing and casing for preventing the access of water to the gas bearing strata. During 1905 the gas well gave out, and upon pulling the steel tubing it was found that for about 35 feet above the packing the pipe was greatly reduced in thickness and broken through in several places. The portion of new tubing was well japanned inside and outside, and destroyed, as shown, just in 30 days after being installed.

The well is located about 1,000 feet from an electric railway and about 2 miles from a sub-power station, and the destruction was caused by the flow of current from the track rails to an adjacent illuminating gas pipe, thence across intervening earth to the service natural gas pipe connected with the gas well tubing, thence across the water above the packer to the casing and adjacent saturated earth. In the first case there was about 35 feet of water above the packer, and in the last case about 10 inches.

Under certain conditions driven water wells, and the underground vertical cylinders or casings of elevators about buildings, are also electrically destroyed by the flow of electric currents over them to adjacent saturated earth.

The flow of trolley currents from the positive pole of a power station via the track rails to well saturated earth, at points distant from such station, is invariably attended with the flow of current from well saturated earth to the negative pole thereof, via the most convenient intervening metal pipe or pipes, or other conductors, which usually causes the electric pitting of the service gas and water pipes and lead sheaths of telephone, telegraph, electric light and other underground cables at the point or points where the current leaves them for the earth and track rails. Such destruction is often manifested within 3 to 12 months. Since 1894 the electric pitting at such points has been prevented by the bonding of such pipes and sheaths with the adjacent track rails, or by their connection with the negative pole of power station. It has, however, been found that such practice causes an increased current flow over the adjacent water and gas mains located between the electric railways and swamps and waterways, attended with the gradual impairment of such mains about their joints, which has been manifested in some cities within 8 to 12 years, and cause their complete destruction. In some cases as high as 3,000 amperes of current have been manifested in connection with such bonded underground metal pipes.

When the negative pole of a power station or the adjacent track rails are solely metallically connected with the lead sheaths of the underground telephone or other electrical cables, the flow of current is facilitated from well saturated earth to such bonded sheaths via the intervening water or other metal pipes, gradually pitting such pipes about their joints and at the points nearest such sheaths.

The recent destruction of a gas tank at Hoboken, N. J., brings up the dangerous practice of connecting the negative pole of a power station with the track rails in the vicinity of a gasholder. In said place the negative pole of the electric power station is connected with the track rails a short distance from the gas works, and adjacent to such track connection point, 12 and 16-inch water mains were electrically destroyed a few years ago.

The conditions for electric pitting about the said gas works and the

creation of an electric spark about the gasholder, especially when well up, are quite favorable.

There is a great collective or suction action in connection with the negative pole of a power station, which can create an electric arc or spark between adjacent rusted, painted, electrically pitted or separated metal pipes or plates located within quite a radius of the power station or track connection point. Some electric fires in buildings are due to such electric arcs created between adjacent separated metal pipes, and the like. Ever since the installation of the first trolley electric railway, at Richmond, Va., in 1888, the trolley railway current has clearly indicated that it must have a proper and efficient ground circuit, independent of the water and gas piping system, as well as the usual metallic circuit embracing the bonded track rails. The impossibility of confining a power current to a metallic circuit in which the bonded track rails form a part, is clearly shown by the grounding and destructive action of the current of the Manhattan Elevated Road, in which the track rails, elevated structure and large copper wires constitute the metallic return, the conductivity of which is many times greater than that of a third rail or outgoing conductor. The great tendency of a power current to leave a metallic circuit and flow in a ground circuit has also been fully shown during the past 25 years with the ordinary multiple electric light circuit. Although the return conductor of such a circuit is continuous, and has the same conductivity as that of the outgoing conductor, the current avails itself of every favorable opportunity to flow in a ground circuit. Many of the electric light fires in and about buildings are now caused by the improper grounding of the neutral wire of the 3-wire system of electric light and power distribution, which encourages the grounding action of the current in buildings and especially in connection with combination electric light and gas fixtures, flexible cords wound around gas pipes, adjacent gas and water pipes and adjacent metal ceilings, laths and other metal work which contact with such grounded metal pipes. The accidental contact of broken or blown down telephone, telegraph and other similar low potential wires, with overhead trolley or electric light wires, is invariably attended with fires in buildings, due to the great grounding tendency of the power currents in such buildings, and notwithstanding the employment of the ordinary safety fuses and other protective devices with such low potential wires.

The question naturally arises why does electricity, and especially a power current, leave a metallic circuit and flow in a ground circuit. In a proper ground circuit it encounters about half the resistance of that offered by a metallic circuit. It does not return through the earth to its source as is generally supposed, and hence its action in a ground circuit is somewhat similar to that of natural electricity. The electricity generated in the thunder cloud flows to the earth and does not return to its source.

All efforts heretofore made to safely and efficiently employ the electric railway current in a ground circuit have failed, for the reason that the proper ground conditions and connections necessary for a power current are generally unknown. I determined over 10 years ago the necessary requirements for a proper ground circuit, for a power current capable of preventing underground electric destruction, but, owing to the unanimity of electric engineers as to the electrolysis theory of 1893, I then realized that some years must elapse before the fallacy of said theory could be fully and generally proven and electric traction properly improved and electrolysis prevented.

I have also discovered that lightning discharges take a prominent part in the electrolysis and gas leakage problems.

The atmospheric electricity in a lightning discharge must readily unite with a great area of highly induced electrified earth, and it has a force capable of shattering a stone or brick steeple and even 20 feet of solid rock.

Every lightning discharge in line with an overhead return power wire connected with such an underground wire, or with an overhead trolley wire having the track rails bonded with the lead sheaths of adjacent underground telephone or other electrical wires, is attended with the shattering of the terra cotta or wooden ducts and the electric destruction of adjacent water or gas pipes is thereby facilitated.

When such a discharge takes place in line with the interior gas pipes of a building, or with an overhead telephone or other electrical wire having a lightning arrester solely grounded on a service gas pipe, and more especially in line with a gas tank, there is invariably some impairment of the joints of adjacent underground gas mains, and particularly in a small city or town, and where solid rock or other high resistance earth is beneath such pipes, such joint impairment and attendant gas leakage are more extensive than many gas engineers seem to have any conception.

In Fitchburg, Mass., and other places lightning discharges in line with the interior water pipes of buildings have been attended with the complete destruction of as high as 3,000 feet of cement lined water pipe by a single discharge. Therefore, rubber, cement or any other non-metallic material at the joints of gas or water pipes, or non-metallic sections at intervals with such pipes, should not be employed to prevent electrolysis. When cement is desired at the joints to prevent gas or water leakage, it is advisable to provide a suitable metallic sheath around such non-metallic joint.

It is about time that the electric railway, lighting and telephone companies are compelled to provide efficient, independent ground connections for their electrical circuits, which can be safely used in conjunction with the underground water and gas pipes to effect a general electrical and lightning protection system for small cities, towns and villages, by which all the electrical and lightning destruction referred to will be prevented, and also all buildings and overhead electrical circuits absolutely protected from damage by lightning discharges. Such system is forthcoming and can be employed in connection with any local electric light and railway or telephone exchange system.

Automatic Ignition of Gas Burners.

The *Journal of Gas Lighting* says that the property of yielding pyrophoric, or spontaneously inflammable, particles when rubbed with a hard object which is often thought to be characteristic of the rare earth metals, is not actually possessed by them in the pure state, and is rather a sign that the respective elements are impure. When they are alloyed with other metals, more particularly with iron, the power of producing sparks on friction appears—growing as the proportion of iron increases, to a maximum of about 30 per cent. and then falling again, to disappear finally when the iron amounts to 75 per cent. At or about the most effective proportion of iron, the alloys give off showers of sparks when lightly rubbed, and the sparks ignite combustible gases, fuses, or wicks saturated with alcohol, without fail or appreciable delay. If the alloys are rubbed more severely, the pyrophoric display takes the form of a flame apparently as large as the hand, which is only accompanied by a little heat or smoke.

It has also been found that the pyrophoric alloys, unlike the metals of the rare earth in them, are hard, brittle, almost completely permanent in air, and capable of being worked with a file without filling up the cuts. The iron can be partly replaced by nickel, cobalt, or manganese, or by mixtures thereof; but a complete absence of iron renders them practically inert. There is a certain difference in behavior among the alloys according to the rare earth metal present. Lanthanum alloys exhibit the brightest light effects; those of cerium give the most pyrophoric sparks. Nevertheless, the differences are not important, and the alloys can be prepared from mixtures of the rare metals. An alloy composed of about 50 per cent. of lanthanum, 30 per cent. of a mixture of neodymium, praseodymium, and cerium, with 20 per cent. of iron, emits a most brilliant light; an alloy of 60 per cent. of cerium, 10 per cent. of other rare earth metals, and 30 per cent. of iron, produces sparks copiously.

It is easy to use an alloy of the latter type to construct a self-igniting incandescent gas burner; the alloy being held in a suitable position, and rubbed by a moveable attachment fixed to the burner cock. An alloy of the former type might also be employed as a flash light in a lighthouse; the substance being fixed in the focus of a concave mirror, and rubbed at the proper time, with any requisite degree of severity, by mechanism operated even from a distance. The alloys, the *Journal für Gasbeleuchtung* reports, are being prepared in the Welsbach factory at Treibach in Carinthia.

Alcohol Calorimeter for Coal Testing.

[Read by PROF. W. M. WALLACE, of the School of Mines, Kimberley, South Africa.]

Of the two ordinary methods of measuring the heating value of a coal the calorimeter is by far the cheaper and quicker, and would be universally adopted in cases where the calorific value of the coal is required without reference to boiler conditions if anything approaching good percentage results were obtained with it.

To make a steam heat, extensive and complete operations have to be carried out, lasting over a considerable period. Accurate methods of stoking must be arrived at for the particular material used; and this involves much testing of flue gases and steam and the constant measurement of temperatures around the plant. On the other hand, a com-

pleta determination of the percentage of water, carbon, ash and the calorific value of a coal in the laboratory by means of a calorimeter should occupy little more than half an hour. That the latter method is not more universally in operation can only be due to the somewhat unsatisfactory nature of the most important desideratum—*i. e.*, the calorific value.

Using the well-known Thomsen calorimeter of the most approved type, the author has found that on the same coal results may easily differ by 3 or 4 per cent.; and, indeed, one can hardly expect anything better when one considers the sources of error inherent in the instrument. The waste gases rising in large bubbles quickly through the water can hardly be expected to give up the whole of their heat to it; the water equivalent of the instrument cannot be exactly determined and must form an important factor. Again, burning 1 gramme of coal in 2,000 grammes of water gives a rise in temperature of 6° or 7° only, which means that the thermometer, if read to tenths of a degree accurately, may give rise to an error of 2 per cent.

Remembering that radiation corrections, themselves difficult to estimate in a calorimeter, whose parts are shifted about from place to place, sometimes cover several tenths of a degree, it is not surprising that the heating value of a coal may be estimated at 14,000 instead of 15,000 B.T.U.

From the Thomsen type of calorimeter the author turned his attention to the much more scientific type on the Carpenter principle, of burning the coal in oxygen gas in a small chamber surrounded by water, the expansion of which is used to indicate the heat value of the coal.

Oxygen gas at a constant pressure is fed into the combustion chamber and the waste gases are passed slowly through a long worm, which is also immersed in the water. The outer vessel inclosing the water has a long glass tube of fine bore attached to its top, in which the heated water expands. The special merit of the method is that the water equivalent determination is done away with, and the radiation correction more accurately applied. The instrument is standardized by burning different weights of pure carbon in it and plotting the graph, showing the relation between calorific value and rise of water in the tube. Again, the rise of water in the tube on burning a gramme of carbon is about 8 inches, so that the percentage error possible, in reading the expansion of the fluid which measures the heating value of the fuel, is reduced at least to a tenth of that in the Thomsen method.

One serious disadvantage, however, presents itself in this method, which is that the determinations must all be made at the same temperature; and since no means of inserting a thermometer in the water is provided by the makers of the instrument, some uncertainty arises here. The bore of the glass tube is made so small—in order to magnify the expansion of the water—that the ratios of the readings are of the same order of magnitude that the expansion of unit volumes of water bear to each other. The very irregular expansion of water makes this a serious objection to the method, as a difference of but 10° in the temperature of the water, for two separate determinations, may make a difference of 25 per cent. in the tube readings; and since no means of accurately gauging the temperature of the water is provided, it is questionable whether the instrument, as it stood, could be reckoned any more accurate than the Thomsen calorimeter.

The author has been engaged on some exhaustive tests of South African coals for the De Beers Company, of Kimberley, and since the changes in temperature of the atmosphere on the high veldt are very rapid and large, some remedy for this defect in the calorimeter supplied had to be found. Obviously, some fluid, whose expansion would be more uniform than that of water, had to be used; and, after repeated trials, alcohol was selected and found to give excellent results; its expansion at different temperatures—within the required range—is practically constant. A further advantage is that alcohol having a specific heat about 0.7, and a much larger coefficient of expansion, allows, by the use of a longer graduated tube, very much more accurate readings with a smaller quantity of coal; for instance, the author found that 0.6 gramme only of Welsh coal gave an expansion in the tube of more than 30 inches. The instrument, in fact, is an immense thermometer, in the bulb of which combustion of the fuel takes place.

Both the weight of the coal and the readings can be obtained correct to a fraction of 1 part in 1,000, and for any desired degree of accuracy it is only necessary to give the radiation correction careful attention. The method of obtaining this correction, stated by Carpenter himself in his book on "Experimental Engineering," appears to the author to be quite inaccurate. The total fall of the fluid in the tube after combustion, during a period of time equal to that of combustion, is taken as the radiation correction; but since the radiation occurs during combustion at a gradually increasing temperature, and not at or near the maximum temperature to any extent, it follows that half Carpenter's correction would be nearer the mark.

But rough approximations of this nature are absurd when one realizes that to make a proper radiation correction requires only a little more attention and calculation. The author adopts the following method which gives excellent results with alcohol as the expanding liquid. The rate of radiation per minute is taken before combustion and with the oxygen flowing. The coal is lit, and the liquid rapidly but at a uniform speed ascends the tube; near the end of the combustion the rapid rising ceases suddenly and is succeeded by a slow crawl. The time when this occurs is noted, and afterwards 1-minute readings are taken until the maximum reading is reached, and 10 minutes or so afterwards, with the oxygen still flowing. The mean of the extreme rates of cooling is then used to correct the temperature after the rapid rise, and the top rate of cooling per minute added successively to the 1-minute readings taken during the crawl until the true maximum temperature is determined. Carpenter also advises that the radiation correction be taken without the oxygen flowing; but since the relatively cool gases continually entering the cylinder during combustion, are absorbing heat, it is obviously wrong to neglect this loss when trying to find the total heat lost.

Another advantage derived by the use of alcohol is the reduced time of the test, since only about half a gramme of coal need be burned. This allows the gases to be swept slowly out of the calorimeter and also reduces the importance of the radiation correction.

Fixed to the apparatus is a tube for the collection of the gaseous products of combustion, which can be measured and analyzed in a few minutes. With the aid of this apparatus a determination of the calorific value, ash, water, carbon and hydrogen can be made in half an hour.

Technical Men as Dividend Earners.

[A paper read by MR. GEORGE D. SHEPARDSON at the Last Meeting of the Iowa Electrical Association.]

Two incidents which have recently come up in the writer's experience have suggested that a paper upon "Technical Men as Dividend Earners" might not be devoid of interest to a wide-awake organization of central station men.

In recommending a young man for a position with a central station operating company, the writer suggested that the young man be engaged upon the basis of a fixed salary, which was to be increased in proportion to the net increase in the company's dividends which might result from his administration. Inquiry among central men as to whether such was not a proper basis for employment of technical men elicited the reply that such a basis of compensation was not generally applicable, for the reason that very few central stations paid any dividends whatever. The editor of one of our leading technical journals recently made the following statements:

"There is one field in particular that sadly needs the technical graduate, and that is the central station field. That industry is not now in very good shape, and this is partly due to the poor management of smaller central stations. Up to 1902 the incandescent lamp output showed an increase during 20 years of almost exactly 20 per cent. per year. In 1903 this fell to 10 per cent., in 1904 to 5 per cent., and now it appears that the output this year will not exceed that of the last year. One of the reasons of this is the better ability of the people running gas plants. The gas plants of this country, with scarcely an exception, are solid commercial properties paying large dividends, and they can afford to pay high salaries to their managers. On the other hand, the great majority of our smaller central stations do not pay dividends, and naturally the tendency has been toward cheap management. The young graduate would be of the greatest value to central stations, not through his technical knowledge, but rather as a man with a well trained mind who in a short time would obtain a broad grasp of the situation and would be always up-to-date in his views and methods. It would, of course, require a year or two in a subordinate position to enable him to gather worldly experience, but after that he should make splendid material as a manager handling the entire central station proposition."

A study of the records of the electrical engineering department of a prominent Western university shows that about 27 per cent. of its graduates are connected with central stations; 22 per cent. have entered telephone engineering; 17 per cent. are engaged with the manufacturers of electric lighting and power apparatus; 10 per cent. are engaged in teaching engineering branches; 10 per cent. are in lines of engineering other than electrical; 8 per cent. are consulting or con-

tracting engineers; 4 per cent. are in work not of an engineering character, and 2 per cent. have died.

During the last 4 years, since the manufacturers turned their attention toward this school, 34 per cent. of the graduates have taken employment with the manufacturers of lighting and power machinery; 24 per cent. are engaged with telephone manufacturers; the lighting and railway operating companies have secured 24 per cent., of whom nearly one-half are with one company. As an indication of the present trend it may be stated that 2½ months before the close of the present school year 8 manufacturing companies had applied for 128 per cent. of the entire class, which is 50 per cent. larger than any preceding class, while operating companies had applied for 25 per cent. of the class.

The above concrete case illustrates what has been understood for some time—namely, that the manufacturers appreciate the value of technically trained men more highly than do the operating companies. It also appears that the large operating companies, and those controlled by syndicates, have secured technically educated men to a far greater extent than the small operating companies. As a matter of fact, if we exclude those working for the large companies or syndicates, practically the only graduates of this department who are working with the smaller companies are those who have financial interests therein. The increasing demand for technical men on the part of manufacturers and operating syndicates is in marked contrast with the small demand for them from the smaller companies.

The reasons why so few technically educated men are connected with the smaller operating companies are in general two: First, that the companies do not seem to want them; second, that the men do not seem to care for such jobs. The companies do not seem to care much for technical men, partly for the reason that over zealous and short sighted sales agents have too commonly urged as one of the desirable features of their system is that "anyone can run it." Another reason is that the amount of business involved will hardly warrant the employment of the highest and most expensive talent. From the standpoint of the technical man, the small station is apt to offer a more monotonous routine, a low salary, fewer advantages and a general lack of appreciation.

These reasons are partly inherent and partly due to an incomplete or incorrect understanding of the true conditions. Almost any station could employ a young technical graduate to the mutual advantage of all concerned. Generally speaking it is better for a young man to obtain some factory experience before settling down as an operating engineer, thereby supplementing his college training (which is necessarily more theoretical than applied) by a year or more of experience in the construction and testing of electrical apparatus in a well organized factory.

A young man entering his work with the central station company should bear in mind that his predecessors have kept the company going and that they could probably continue so to do without his services. He should usually occupy a comparatively unimportant position and should be advanced as he proves his worth. The station owners, on the other hand, should realize that the young technical graduate has only laid the foundation for future development, that he is not yet a full blown engineer, but that he has within him the making of one. The young man should rapidly prove his worth to the company by carefully attending to his duties, with proper respect for the knowledge gained through experiences on the part of those above him. As a general rule a young man should not attempt or propose any radical changes in the practice of the company until he has become thoroughly acquainted with the operating and financial conditions. He should strive to make the best he can of equipment and facilities available. He should call for new or added equipment only after he has proved his ability to make the best possible use of that already at hand. A high grade of skill is required to secure good results from poor equipment, and the young man who can secure better results with the same equipment will certainly win the confidence of his superiors. The small station offers a more attractive field to some young engineers than a large one, since its operating conditions are more easily grasped, the financial conditions are much more likely to be accessible to him, and he can sooner secure a grasp of the whole economic situation. He should, therefore, become capable of assuming responsible charge in a small station much more quickly than in a large one. Men of somewhat different makeup will prefer to obtain their initial experience in a large company where everything is on a larger scale, where the engineering force is more specially organized, and where there is a long line of promotion in one company.

The young engineer with a technical training should soon be able to diagnose conditions of poor operation and to prescribe suitable remedies. A careful study of the results obtained in the boiler room often indicates sources of gross inefficiency and loss which were unsuspected by the owners or operators, but which nevertheless vitally affect the dividends. A study of the voltage on the line will often indicate desirable changes in the distribution of copper and in the handling of generators which will lead to beter performance of the lamps and thereby to greater satisfaction and to added income. An inspection of lighting devices, including the location and efficiency of the lamps and reflectors with the gradual elimination of the ancient relics, will gradually bring about increased satisfaction on the part of the consumer with comparatively little outlay on the part of either operating company or consumer. The technically trained man should be able to locate sources of loss, to identify conditions which cause poor economy. He should not be afraid to bring about gradually the entire reconstruction of the plant, if necessary to its financial success, bearing in mind that he must not build a monument over his own grave, and that dividends are a true measurement of an engineer's success.

To show that the above generalizations are not simply ideal abstractions, a few illustrations from the actual experiences of some of the graduates mentioned are submitted.

By correcting leaky boiler settings, and an insufficient stack which had prevented complete combustion, one young engineer effected a saving of 20 per cent. of the fuel bill. The same engineer in another position reduced the fuel consumption by 30 per cent. simply by properly cleaning the feed water heater and boiler. This young man in another position decreased the fuel consumption 30 per cent. by setting the valves, after taking cards from an indicator which the chief engineer had, but whose cards he did not know how to interpret in such way as to understand the cause of the poor performance. A young man, who had not yet completed his technical course at the University, was sent to look over a plant which was so heavily overloaded that the owners were about to install larger machines; by careful inspection he was able to locate so much poor insulation that, after overhauling the lines and reducing leakage losses, he increased the number of lights installed by about one-third, and even then the load was one-fifth less than before his arrival.

By use of portable voltmeters many young engineers have been able to locate the cause of much dissatisfaction and loss. For example, a series of tests with portable voltmeters showed that poor regulation, caused by improper balance of load on different feeders, and by the failure to tie together the secondaries in the business district, was the reason why the company had been compelled to renew each year about one-tenth of the entire number of incandescent lamps connected. In another place complaint due to poor lights was explained by tests with a portable voltmeter, which showed 128 volts delivered where the lamps were intended for 110 volts. This trouble was traced to a wireman who had connected service wires to the pressure wires which ran back to the station.

Numbers of cases of poor service were traced to spliced joints which had been carefully taped without soldering. In one case a voltage variation of 15 per cent. in different parts of the town was corrected by transferring part of the load to the other legs of a 3-phase circuit, by installing larger transformers and heavier secondary circuits in the crowded districts and by moving the small transformers to the thinly lighted districts.

In another case the load on the station was reduced 50 per cent. by introducing the general use of meters; this allowed the connection of a large additional load without any increase of equipments except the meters and service wires. Experience showed that the reduction of the load by changing from flat rates to meters did not involve a corresponding decrease in revenue. Attention to the proper care of customers' meters has resulted in a marked increase of revenue. One young man reported that when he took charge several years previously it was quite common to find monthly meter charges of only a few cents even in winter time; after cleaning and connecting meters and establishing a minimum monthly charge, the financial improvement earned his salary several times over.

The young engineer who brings financial success to a company which has been leading a precarious existence will find his services in demand in larger fields, especially when the plant which he has been operating is owned by a syndicate. In fact, the growth of syndicate ownership of central stations is a factor which makes central station operation more and more attractive to the young engineer.

The fact that a technically trained man is likely to remain with a small company only a short time should not deter the small company from employing him; for if he has good judgment he will more than earn his salary while with the company, and the practices which he

will inaugurate will in all probability continue to benefit the company long after his active connection with it has ceased.

In order to eliminate one of the great drawbacks to entering the employment of a small company—namely, the lack of opportunity for financial advancement—an attractive plan is somewhat as follows: To offer a young engineer a salary upon which he can live comfortably during his apprenticeship; when he has shown his ability to handle the situation, place him in responsible charge with a reasonable salary and with the stipulation that he is to receive a certain per cent. of all net income in excess of that previously secured, it being understood, of course, that due allowance is to be made for any increased investment made through his recommendation. Incidentally, it may be suggested that in general the plan of profit sharing with employees should produce results for central stations quite as marked as those obtained in manufacturing and other lines of business.

Not so Good as it Looks, Perhaps.

The Consumers Light, Heat and Power Company is the title of a new corporation which has recently been chartered, and which is getting ready for business in Fort Worth, Tex. When this company completes its plant and other arrangements for active business, there will be three corporations at Fort Worth in the field to supply the people of that city with electric utilities.

Before congratulating our enterprising North Texas city on this evidence of unusual electrical activity within her precincts, it may be well to take into consideration the reasons for it, as afterthought may not lead to a favorable decision on the evidence. Why should a city the size of Fort Worth require the services of three separate corporations in the furnishing of the utilities they are formed to provide? If such extraordinary public service is "required," the natural inference to be drawn from that fact is that the demand for electricity in Fort Worth is greater than a smaller complement of factors engaged in furnishing it can supply—a situation that would be most creditable to the progressiveness of Fort Worth. However, as it is announced that the new Consumers Electric Light and Power Company has made a watt rate something like one-half the rate of the old companies, it is fair to assume that a third company has come into the field basing its prospects for patronage not upon the supplying of a demand for electrical service that has grown beyond the capacity of the existing companies, but on the procuring of already provided for business through the attraction of very low rates.

In other words, this third solicitor of the patronage of Fort Worth in the electrical light, heat and power line comes into the field, evidently, with the battle cry of "Competition" emblazoned on its banners. Has there been, then, protest and remonstrance that the existing condition of electric supply in Fort Worth stood for exorbitant rates, the same being made possible by absence of competition? We have not heard that such was a fact. Indeed, as to the rate prevailing at Fort Worth, compared with that of cities of the same class throughout the country, it has been lower than the average. And as to the check of competition, two companies have long been operating in the lively Panther City, and that they have been in active business rivalry there is ample evidence. That there was competition, therefore, is plain, and it is perhaps reasonable to assume that to this competition Fort Worth enjoyed a watt rate lower than some other cities, not only in Texas, but elsewhere. Admitting, for argument's sake, the efficiency of such competition in the fixing of rates, it is certainly equally reasonable to assume that the rate thus compelled was one based on calculations of cost of production and distribution made as close to the line of necessary charge for service as safe busines conduct would permit, if the quality of the service and its efficiency were to be preserved. This would be the natural and proper sequence of healthy competition. Therefore, this reinforcement of competition in electric utilities in Fort Worth, entering the lists with the challenge of rates cut in two, may result to the temporary benefit of users of these utilities, but, unless calculations heretofore made of the cost of such service are erroneous, the cut rate of the new company will not produce adequate return on the investment and for the work. Naturally, the old companies will be forced to revise their list to meet this rate or suffer loss of patronage. And, also naturally, the service will suffer in quality and efficiency, for it is not in the hearts of men to give something for nothing.

Electrician is not to be understood as deprecating increase in the number of light, power and heat companies, either in Fort Worth or elsewhere. Far from it. It hails the announcement of the coming into the field of such new utilities, and records it with pleasure, for it is the chronicling of the advancement of electrical development and all the benefits that such development implies. Nor are we to be taken as opposing the adopting of low rates of service, nor as defending the maintaining of an unreasonable or extortionate rate. We simply take this case of Fort Worth as the illustration of a principle. "Competition," the saying goes, "is the life of trade." True, perhaps, as an abstract principle. But competition may likewise be the death of trade. Unless what are claimed to have been careful estimates of what the cost of good electrical service in cities are all wrong, such competition as this at Fort Worth is unhealthy and ominous. If these estimates are erroneons, then we congratulate this new electrical company in the Panther City on having discovered the fact, and we congratulate the Panther City on being the first beneficiary of the problem's solution.—*Electrician.*

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

A CORRESPONDENT in Grand Rapids, Mich., writing under date of the 28th inst. incloses the iollowing: "Mr. A. F. Turner, Superintendent and Engineer of the Grand Rapids Gas Light Company spoke before about 125 of the Company's employees, the night of April 28th, the session being held in the Company's Ottawa street offices. His subject was the 'Manufacture of Illuminating Gas.' He illustrated his remarks with a working model of a modern coal gas plant constructed by himself and Chemist William Seymour and followed the process from the time the coal entered the retort until it reached the consumer. The model itself was, with the exception of the retort, entirely constructed of glass, and the different processes used in purifying the gas were clearly shown. The removal of tar, ammonia and sulphur could be plainly seen and from the gasholder a burner consumed the gas manufactured. Superintendent Traver also explained the manufacture of water gas with the aid of diagrams and explained the workings of the modern appliances used to-day in the works. Later in the evening light refreshments were served. This 'talk' was the first of a series that will be given by the Company to its employees during the coming season. At some future time Mr. John Hellen, Superintendent of the street department, will talk on the distribution of gas, and later Secretary Glenn R. Chamberlain will talk on experiences with the consumer."

WHOEVER designed and executed "Booklet No. 2" for the Cruse-Kemper Company, of Philadelphia and Ambler, Pa., were certainly artists. It is a beauty.

THE Wilkes-Barre (Pa.) Gas and Electric Company reports a large increase in gross and net earnings.

"BULLETIN 39," recently issued by the Bristol Company of Waterbury, Conn., has to do with a description and price list of the Company's patent steel belt lacing, and it includes mention of several new sizes recently placed on the market. The circular gives the list in a condensed and tabular form, enabling the reader to see at a glance the relation that exists between the different styles and sizes.

MR. FREDERICK BROCKINGTON is now in charge of the gas plant at Laconia, N. H. Mr. E. R. Tucker is his successor at Leominster, Mass. It is virtually only a change of positions.

A CORRESPONDENT in Alton, Ills., forwards the following under date of the 26th ult.: "Announcement was made to-day that Mr. R. W. Bailey, of the East St. Louis and Suburban Traction Company, has been appointed to supercede Mr. J. F. Porter at Alton in charge of the properties of the new Company owning the Alton Gas and Electric Company, the Alton Granite, and St. Louis Traction Company and the Edwardsville, Alton and St. Louis Traction Company. Mr. Bailey was here to day to take charge of the property and get acquainted with the work. Mr. J. F. Porter, who will retire from active management of the property, will sever his connection with the Company May 1. He has been desirous of being freed from his duties as General Manager of the property since the sale was negotiated. The office of Superintendent of Properties was therefore created and Mr. Bailey was designated to take charge. He will have his office in the building occupied by the old Company and he will hold down the desk and chair which Mr. Porter has occupied for so many years. Mr. Bailey will be the man to whom all the Alton people will look to right their wrongs, receive their complaints and give them good service. There will be general regret in Alton over the severance of Mr. Porter's relations

with the Company. He has always been ready to receive complaints as to service and right grievances wherever it was possible to do so. He has given general satisfaction as an official and the Alton patrons of the Company will no doubt have cause frequently to miss him, as he was the final arbiter in all disputes, whereas in the future the Superintendent of Properties, who will be the Alton representative, will be subordinate to General Manager L. C. Haynes, of East St. Louis, Ills. Notice was given to the employees of the Company to day that all of them would hold their positions and that they will be expected to give all respect to the authority of Mr. Bailey as Superintendent of Properties. He will have charge of the street railway, electric light plant, gas works, hot water heating plant and the interburban lines operated by the Alton, Granite and St. Louis and the Edwardsville, Alton and St. Louis Traction Companies."

MR. GEORGE W. GRAVES has cancelled his contract with the Albany Foundry Company, of Albany, N. Y.

THE Boston section of the Illuminating Engineering Society held its second meeting the evening of the 24th of April in the American House, Boston. The paper for the evening was prepared by Mr. N. W. Gifford, who thought the proper title for it was "Some Suggestions from the Gas Side." Dr. Louis Bell also had a characteristic speech ready for the members.

THE New York *Tribune*, of recent date had this to say: "The Peekskill (N. Y.) Lighting and Railroad Company capitalized in $1,400,000, which furnishes gas and electricity to Peekskill and the adjacent territory and operates 10 miles of electric trolley lines, was acquired recently by the interests controlled by Mr. F. A. Stratton, of Mount Vernon, and it is remored that it will be merged into the Northern Westchester Lighting Company, of which Mr. Stratton is President, and which is capitalized for $2,000,000. The Peekskill Company was the last outstanding lighting company in Westchester county not controlled by the Westchester and Northern Westchester Lighting Companies. After closing a deal a new Board of Directors was elected, with Mr. Stratton as President, and they took immediate steps to contract for a new plant and several other improvement and additional machinery. The Peekskill trolley system will be extended to Ossining, for a connection with the proposed lines of the Hudson River and Eastern Traction Company. This will give the people of Peekskill an almost direct connection with the county seat at White Plains and the eastern side of Westchester county."

WE are informed that contracts for the construction of the gas plant that is to supply the contiguous settlements of Glassboro, Clayton and Pitman, N. J., have been awarded, and the proprietors say they will be ready to supply gas by August 30th.

A CORRESPONDENT in Detroit, Mich., writing under date of April 29th, incloses this mention: "Electricity was relegated to the dim and misty past while gas held the center of the stage at the farewell dinner given to Mr. Alanson P. Lathrop by some of his friends at the Detroit Club last night. Mr. Lathrop is General Manager of the Detroit City Gas Company, but leaves shortly for New York, where he will take a prominent position with the parent company. Nothing could have been more appropriate than the arrangements and decorations of the table. Everything, from the lighting of the room to the dainty placecard at each diner's plate, spoke more eloquently than words of gas. Electric lights were frowned upon for the nonce and directly over the round table, where sat Mr. Lathrop and 14 friends, were 2 big gas arc lights, containing 8 burners. The guests were somewhat startled to behold, on sitting down, that they were confronted by a gas bill, which read with clerical preciseness that the last statement was made April 28. When the bill was turned around, however, it displayed a menu of choice things to eat. This unique bill of fare was inclosed by a Welsbach burner. Gas joints of the latest pattern were used as napkin rings. Cigarettes were daintily incased in Welsbach burners, while the cigars reposed in sections of gas pipe. The place cards were 'riser tags,' such as are filled out by gas inspectors. In an adjoining room a large gas range was utilized for culinary purposes. Gas pliers were used for nut crackers. American beauties under a huge canopy of smilax formed the centerpiece. From the big arc lights in the center hung ropes of smilax which artfully concealed gas tubing that led to each diner's place and served to keep a cigar lighter supplied. The cigar lighters were statuettes of graceful design. Floating mysteriously above the heads of the diners were big red balloons, on which were printed the significant words, '80-cent gas.' Besides the guest of honor there were present Messrs. E. G. Pratt, A. W. Atterbury, W. H. Ball, A. B Wetmore, E. M. Mancourt, Jules Hoffman, T E. Reeder, A. H. Green, Jr., C. G. Anderson, John H. Avery, C. W. Baird, John Scott, Dr. W. E. Rice and William Baur.

MR. ALTON D. ADAMS, a man who knows something about electricity, and virtually nothing about gas, has been engaged by Mayor Coughlin, of Fall River, Mass., to "investigate" the rates charged for and the quality of the gas served by the Fall River Gas Light Company.

IT is quite likely that Great Barrington, Mass., will have a gas plant before the end of 1906. It could well support one.

THE following is the programme which has been arranged for the meeting of the Southwestern Gas and Electric Association, which is to be held in Galveston, Tex., May 16, 17 and 18:

Wednesday, May 16: Meeting of executive committee, 9 A.M. Morning session, 10:30 A.M. Address of welcome, by the Hon. H. C. Landes, Mayor of Galveston. Election of new members. Address by the President. Paper, "Up-to-Date Methods of Increasing the Business of Public Service Corporations," by G. C. Gum. Question box discussion. Afternoon session, 2:30 P.M. Election of new members. Paper, "Extracts from a Letter from Frederic Egner on Retort House Practices." Question box discussion. Executive session.

Thursday May 17: Morning session, 10:30 A.M. Paper, "What is Electricity?" by S. J. H. White. Paper, "Relations of Public Service Employees to the Public," by Frank J. Duffy. Question box discussion. Afternoon session, 2:30 P.M. Paper, "Care, Maintenance and Inspection of Street Railway Rolling Stock," by H. S. Cooper. Question box discussion. Immediately after adjournment a visit to the sea wall, the grade raising dredges and grade raising operations will be made. Later in the evening the Sons of Jove will give a public "grand rejuvenation."

Friday, May 18: Morning session. Paper, "Telephone Engineering Problems," by F. W. Yenson. Paper, "Organization and Operation of Purchasing and Supply Departments," by A. W. G. Birtwell. General business. Report of committees. Report of Secretary and Treasurer. Election of officers. Excursion down the harbor to the jetties. The following is a list of the officers of the Association: President M. M. Phinney; First Vice-President, J. W. McLendon; Second Vice-President, E. W. Dunaway; Third Vice-President, J. P. Crerar; Secretary Frank J. Duffy; Treasurer, A E. Judge. Executive Committee: M. M. Phinney, Dallas, Tex.; J. W. McLendon, Fayetteville, Ark.; J. P. Crerar, Denison, Tex.; F. N. Drane, Corsicana, Tex.; R. B. Strichter, Sherman, Tex.; E. W. Dunaway, Dallas, Tex.; J. F. Strickland, Dallas, Tex.; W. S. Rathell, Waco, Tex.; Wilbur H. Young, Austin, Tex.

The Heaving of Piles by Frost.

Engineering News quotes a curious experience with the heaving of piles in frozen ground occurring recently at a trestle built across one of the many muskeg swamps west of Winnipeg, on the Grand Trunk Pacific Railway. The structure is a 3-deck frame trestle, with 7 piles under each bent, and the piles were driven to an average depth of 30 feet; the first 10 feet was soft muskeg and below this was a mixture of sand and clay. The penetration during the last blows of the pile driver was only 1 or 2 inches; a 2,200-pound hammer was used, having a maximum drop of 40 feet. The 3 center piles were spaced 2½ feet c. to c., and capped with a 12 × 12-inch sill 10 feet long; beyond these were two piles, of 5 feet and 11 feet spacing, supporting the inner and outer batter posts on a long sill. When the ground froze, the outside piles were raised about 3 and 4 inches, but the other piles showed no disturbance whatever, although no reason for this has been given. This heaving occurred only at bents where the superstructure had not been erected, but was framed and lying on the bents ready for raising, the piles having simply the sills drift-bolted to them. Instead of cutting the piles off, as is usually done, the pile driver was put on again and they were driven home with a few light blows of the hammer; but even heavy blows failed to increase the penetration, showing that the piles were simply settled back to their original position. This trestle is about 2,200 feet long, with a maximum height of 80 feet. For the above particulars we are indebted to Mr. Maurice A. Burbank, Resident Engineer of the section on which the trestle was built.

THE AMERICAN GAS LIGHT JOURNAL

A. M. CALLENDER & CO.,
PROPRIETORS.

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NOTIFICATION RESPECTING ADVERTISING.

Orders for new advertising, or for changes in standing advertisements, to insure attention in the issue following their reception, must be in hand any time of Wednesday.

AGENTS:

New York—American News Co., 39 and 41 Chambers St
Germany—Lemcke & Buechner, of New York.
England—Aug. Siegel, 30 Lime Street, London.

MONDAY, MAY 7, 1906.

The Market for Gas Securities.

The "worst having been told" about the dividend on Consolidated gas last week, this week there was quite a recovery, the stock closing to-day (Friday) at 138 to 138½, a rise of virtually 7 points for the week. Some of those short of it may "recover" suddenly.

Brooklyn Union remains unaccountably weak; Peoples of Chicago, is advancing, and it will advance; Washington (D. C.) is 300 bid, and we have no doubt that by July 1st it will be selling at 325. Consolidated of Baltimore is nominally offered at 85½. Buy it.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks,

15 WALL STREET, NEW YORK CITY.

MAY 7.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share.

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked.*
Consolidated	$78,177,000	100	138	138¼
Central Union, Bonds, 5's	3,000,000	1,000	108	110
Equitable Bonds, 6's	1,000,000	1,000	..	105
" 1st Con. 5's	2,300,000	1 000	118	120
Mutual	3,500,000	100	255	270
Municipal Bonds	720,000	..	..	..
New Amsterdam Gas Co., Bonds, 5's	11,000,000	1,000	105	107
New York & Richmond Gas Co. (Staten Island)	1,500,000	100	37	43
1st Mtg. Gold Bds. 5 p. ct.	1,000,000	..	98	104
Northern Union, Bonds, 5's	1,250,000	1,000	106	107
New York and East River.. Bonds 1st 5's	3,500,000	1,000	108	111
" 1st Con. 5's	1,500,000	..	104	110
Standard	5,000,000	100	140	160
Preferred	5,000,000	100	155	175
Bonds, 1st Mortgage, 5's	1,500,000	1,000	111	114
Yonkers	299,650	500	180	..
Out-of-Town Companies.				
Brooklyn Union	15,000,000	100	190	193
" " Bonds(5's)	15 000,000	1,000	112	113
Bay State	50,000,000	50	5/16	¾
" Income Bonds	2,000,000	1,000	..	75
Binghamton Gas Works	450,000	100	..	65
" 1st Mtg. 5's	509,000	1,000	95	100
Boston United Gas Co.— 1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	9	10
" " Bonds, 5's	5,250,000	1,000	75	80
Capital, Sacramento	500,000	50	..	35
Bonds (6 s)	150,000	1,000	..	..
Chicago Gas Co. Guaranteed Gold Bonds	7,650,000	1,000	104	106¾
Cincinnati Gas and Electric Co.	29,500,000	100	101½	101¾
Columbus (O.) Gas Co., 1st Mortgage Bonds	1,500,000	1,000	90	..
Columbus (O.) Gas Lt. & Heating Co	1,682,750	100	..	95
Preferred	3,026,500	100	107½	108
Consumers, Toronto	,000,000	50	200	204
Consolidated, Baltimore	11,000,000	100	..	85¼
Mortgage, 6's	3,600,000	..	..	118
Chesapeake, 1st 6's	1,000,000	..	..	..
Equitable, 1st 6's	910,000	..	..	..
Consolidated, 1st 5's	1,490 000	..	..	112
Consolidated Gas Co. of N. J.	1,000,000	100	15	17
" Con. Mtg. 5's	880,000	1,000	92	95
Bonds	75,000	..	..	100
Detroit City Gas Co	5,000,000	50	..	50
" Prior Lien 5's	4,618,000	1,000	..	98
Detroit Gas Co., 5's	381,000	1,000	75	80
" Inc. 5's	16,000	100	98½	100
Equitable Gas & Fuel Co., Chicago, Bonds	2,000,000	1,000	..	101
Essex and Hudson Gas Co.	6,500,000	..	39	40
Fort Wayne	2,000,000	..	..	..
" Bonds	2,000,000	..	55	..
Grand Rapids Gas Lt. Co. 1st Mtg. 5's	1,225,000	1,000	104½	105
Hartford	750,000	25	190	200
Hudson County Gas Co., of New Jersey	10,500,000	..	110	112
" Bonds, 5's	10,500,000	..	107½	108½
Indianapolis	2,000,000	..	60	70
" Bonds, 5's	2,650,000	..	104½	105
Jackson Gas Co	250,000	50	82	..
" 1st Mtg. 5's	290,000	1,000	97	100
Kansas City Gas Light Co., of Missouri	5,000,000	100	..	36
Bonds, 1st 5's	3,822,000	1,000	102	104
Laclede, St. Louis	10,000,000	100		105
Preferred	2,500,000	100	95	110
Bonds	10,000,000	1,000	108½	109
Lafayette Gas Co., Ind.	1,000,000	100	..	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas & Elec. Co. " 1st Mtg. 6's	350,000	1,000	106	108¾
" 6 per cent. scrip, due 1910	100,000	25	85	87
Montreal, Canada	2,000,000	100	218	218¾
Nashville Gas Lt. Co.	1,000,000	100	110	..
Newark, N. J., Con. Gas Co. Bonds, 6's	6,000,000	..	58	58
	6,000,000	..	137	138
New Haven	2,000,000	25	200	..
Peoples G. L. & Coke Co., of Chicago	25,000,000	100	91⅝	91⅞
Peoples Gas Lt. & Coke Co., Chicago, 1st Mortgage	20,100,000	1,000	..	..
2d "	2,500,000	1,000	104	..
Rochester Gas & Elec. Co.	2,150,000	50	88	..
Preferred	2,150,000	50	115	..
Consolidated 5's	2,000,000	..	104½	105½
San Francisco, Cal.	15,800,000	100		..
St. Joseph Gas Co. " 1st Mtg. 5's	751,000	1,000	92	..
St. Paul Gas Light Co.	1,500,000	100	45	47
1st Mortgage 6's	650,000	1,000	113	116
Extension, 6's	600,000	1,000	112½	115
General Mortgage, 5's	2,465,000	1,000	96¼	..
Syracuse, N. Y.	1,975,000	100	50	55
Bonds	2,047 000	1,000	102	..
Washington, D. C	2,600,000	20	300	305
First mortgage 6's	600,000	..	..	..
Western, Milwaukee	4,000,000	..	..	..
Wilmington, Del	600,000	50	230	..

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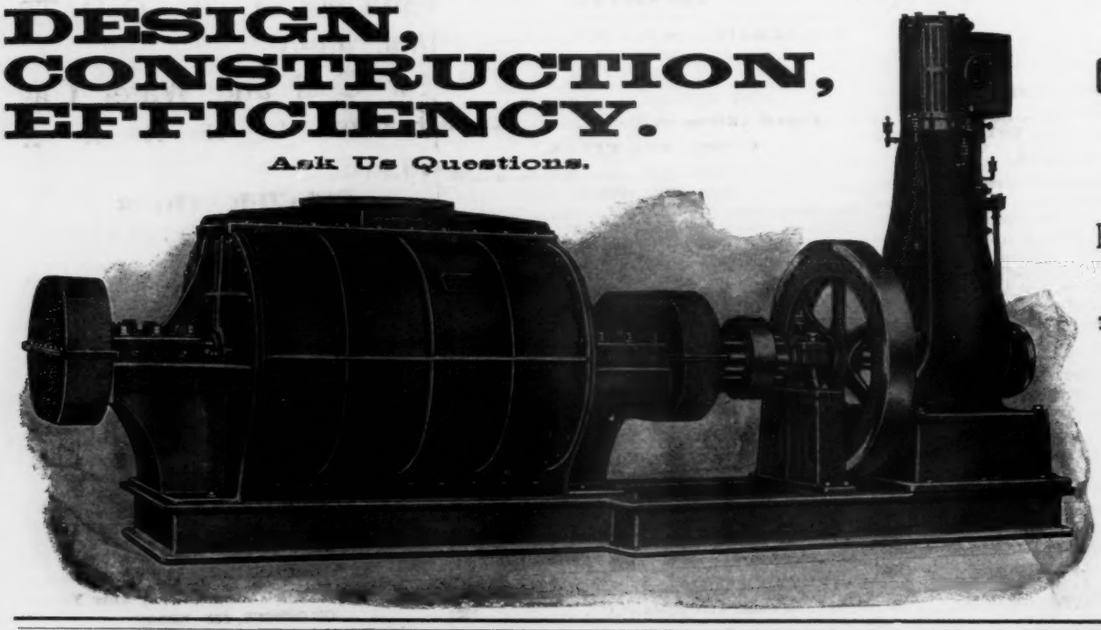

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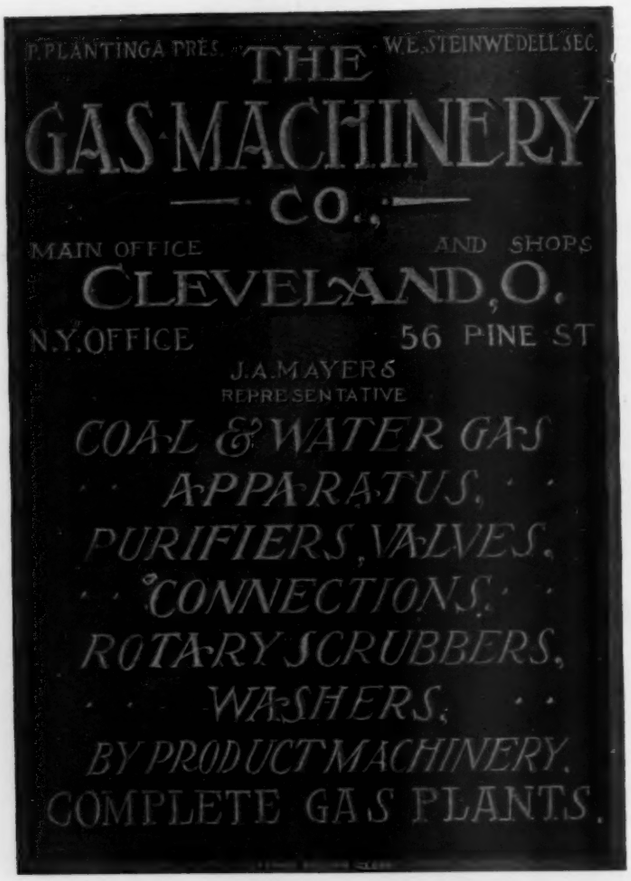

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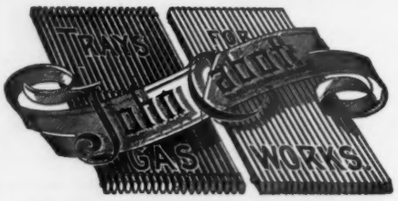

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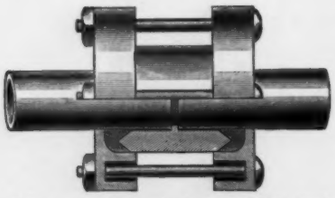

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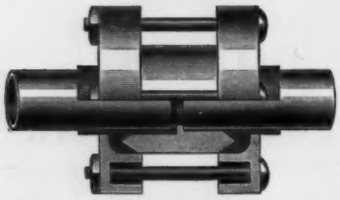

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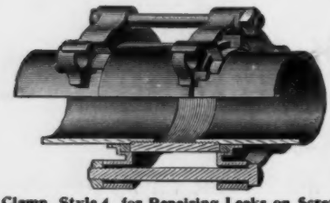

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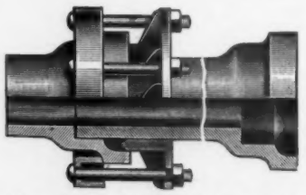

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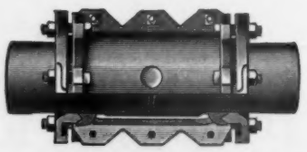

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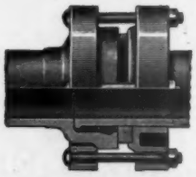

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Contact 6	29.00	¾ "	3	29½ "	12 "	60 "
" 8	23.50	½ "	2½	28⅛ "	10¾ "	48 "
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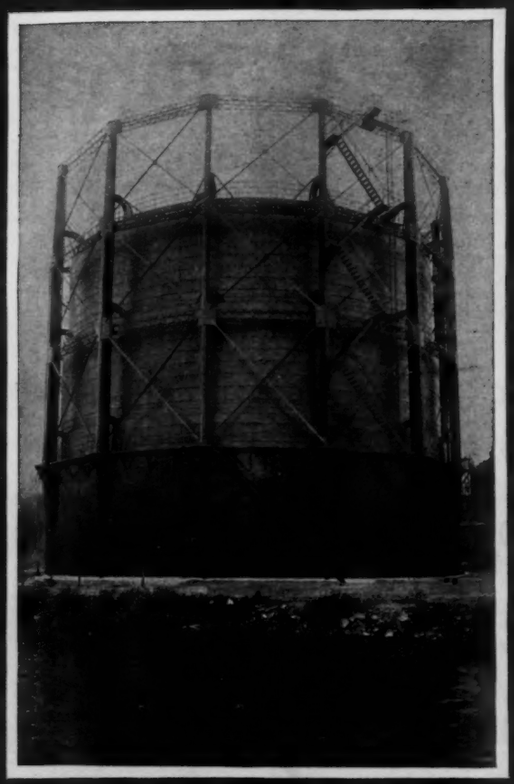

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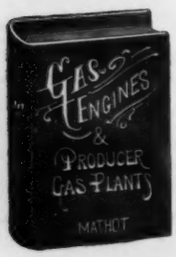

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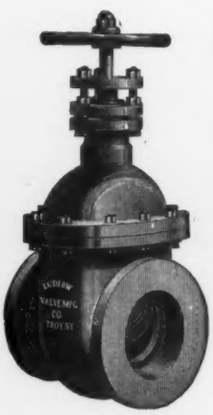

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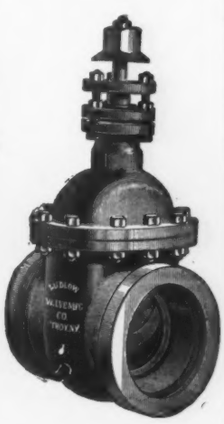

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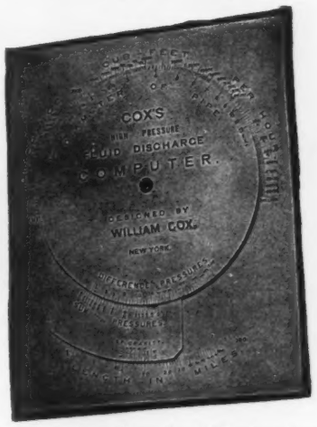

This Computer solves the following formula, which is applicable to Gas, Air and other elastic fluids, flowing through long pipes with high initial pressures:

Discharge in cubic feet per hour at atmospheric pressure $= 33.3 \sqrt{\frac{d^5 \times (p_1^2 - p_2^2)}{L \times w}}$

Where
d = diameter of pipe in inches,
p_1 = absolute initial pressure in pounds per square inch,
p_2 = absolute terminal pressure in pounds per square inch,
L = length of pipe in miles,
w = specific gravity of the fluid when air = 1.

To Find the Discharge from a Pipe and the Required Size of Pipe.

(1.) Set the specific gravity of the fluid opposite the length of pipe;

(2.) Bring the DIFFERENCE of the initial and terminal gauge pressures opposite the SUM of the initial and terminal gauge pressures;

(3.) Opposite any diameter of pipe will now be found the discharge in cubic feet per hour at atmospheric pressure; and

(4.) Opposite any desired discharge will also be found the required diameter of pipe.

Price of the Computers, in Cloth Case, 6½ x 8 inches, $5 Each, Net.

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By JOHN HORNBY, F.I.C.

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Valuation of Gas, Electricity and Water Works

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NO. 17, "MUELLER SWIVEL NO. 2" MACHINE.

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While you can stand any machine upon the pipe so that the tool is perpendicular, you can't keep them all exactly that way until they are made fast, because the chain must be tightened wholly from one side, which compresses the gasket unevenly and pulls the machine out of plumb.

Mueller Swivel Gas Tapping Machines have chain nuts on both sides, so that the chain tension can be kept even and the gasket compressed the same on both sides. The tool can be kept perpendicular while the machine is being secured to the pipe.

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Each machine is carefully inspected and assembled, is given a working test as near like actual service use as possible, bears the Mueller trade mark, and is *unconditionally guaranteed.*

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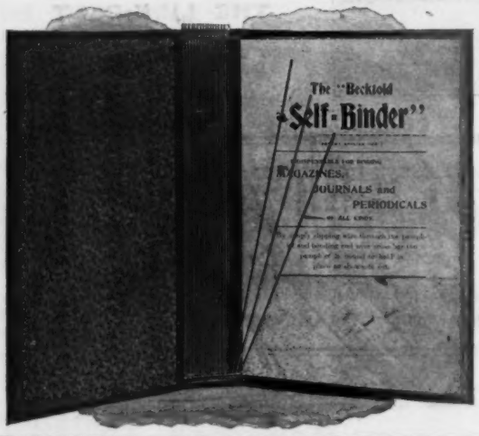

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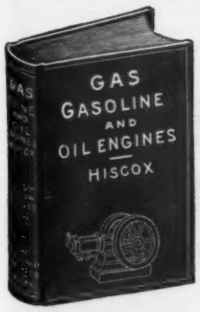

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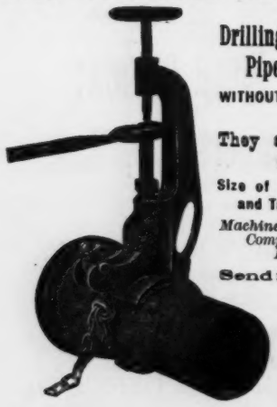

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WITHOUT ANY ESCAPE OF GAS.

They are Strong and Compact.

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Machines Sent to any Gas Company for Thirty Days' Trial.

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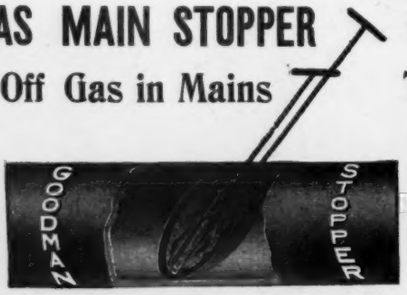
Any size gas main can be shut off in 30 seconds. : : :



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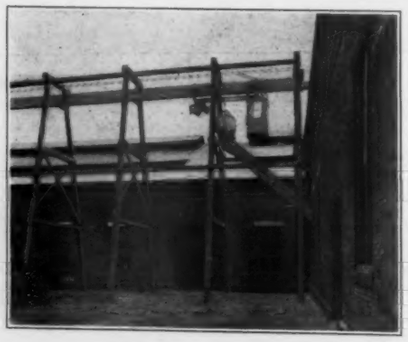

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THE PURIFIED GAS REVIVES THE FOULED OXIDE.

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OPEN TOP CARRIER.

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Or any heavy or gritty materials, where strength and durability are essential. Constructed in any length or capacity, and to suit local conditions.

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Photometrical and Experimental Apparatus.

PUBLIC LIGHTING TABLE.

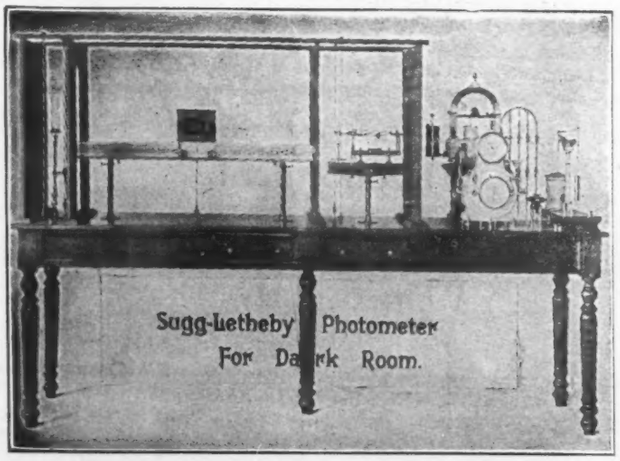
MAY, 1906.

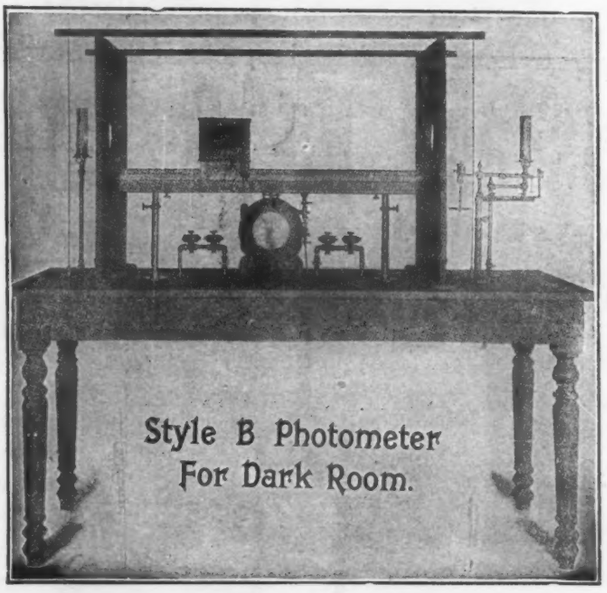
Day of Week.	Table No. 1. FOLLOWING THE MOON. Date.	Light.	Extinguish.
Tue.	1	12.30 AM LQ	4.00 AM
Wed.	2	1.10	4.00
Thu.	3	1.50	4.00
Fri.	4	2.20	4.00
Sat.	5	3.00	4.00
Sun.	6	3.30	3.50
Mon.	7	No L.	No L.
Tue.	8	No L. FM	No L.
Wed.	9	No L.	No L.
Thu.	10	7.30 PM	10.40 PM
Fri.	11	7.30	11.40
Sat.	12	7.20	12.40 AM
Sun.	13	7.40	1.20
Mon.	14	7.40 LQ	2.00
Tue.	15	7.40	2.40
Wed.	16	7.40	3.10
Thu.	17	7.40	3.40
Fri.	18	7.40	3.40
Sat.	19	7.40	3.40
Sun	20	7.40	3.40
Mon.	21	7.40	3.40
Tue.	22	7.40 NM	3.40
Wed.	23	7.40	3.40
Thu.	24	7.40	3.40
Fri.	25	7.40	3.40
Sat.	26	7.40	3.40
Sun.	27	9.50	3.30
Mon.	28	10.30	3.30
Tue.	29	11.10	3.30
Wed.	30	11.50 FQ	3.30
Thu.	31	12.20 AM	3.30

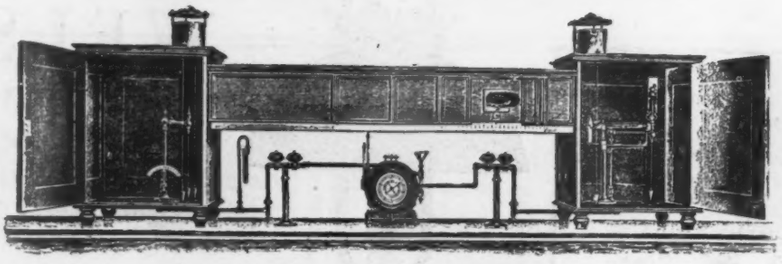
TOTAL HOURS DURING 1906.

By Table No. 1.

	Hrs.Min.
January	223.40
February	190.40
March	192.10
April	167.00
May	152.20
June	142.10
July	150.20
August	157.40
September	170.00
October	185.10
November	201.40
December	214.00
Total, yr.	2146.50







Closed Photometer For Light Room.

CIRCULARS SENT ON REQUEST.

PUBLIC LIGHTING TABLE.

MAY, 1906.

Day of Week.	Table No. 2. NEW YORK CITY. All Night Lighting. Date.	Light	Extinguish.
		P. M.	A.M.
Tue.	1	6.45	4.00
Wed.	2	6.45	4.00
Thu.	3	6.45	4.00
Fri.	4	6.45	4.00
Sat.	5	6.45	4.00
Sun.	6	6.45	4.00
Mon.	7	6.55	3.40
Tue.	8	6.55	3.40
Wed.	9	6.55	3.40
Thu.	10	6.55	3.40
Fri.	11	6.55	3.40
Sat.	12	6.55	3.40
Sun.	13	6.55	3.40
Mon.	14	7.00	3.30
Tue.	15	7.00	3.30
Wed.	16	7.00	3.30
Thu.	17	7.00	3.30
Fri.	18	7.00	3.30
Sat.	19	7.00	3.30
Sun.	20	7.00	3.30
Mon.	21	7.10	3.15
Tue.	22	7.10	3.15
Wed.	23	7.10	3.15
Thu.	24	7.10	3.15
Fri.	25	7.10	3.15
Sat.	26	7.10	3.15
Sun.	27	7.10	3.15
Mon.	28	7.15	3.15
Tue.	29	7.15	3.15
Wed.	30	7.15	3.15
Thu.	31	7.15	3.15

TOTAL HOURS DURING 1906.

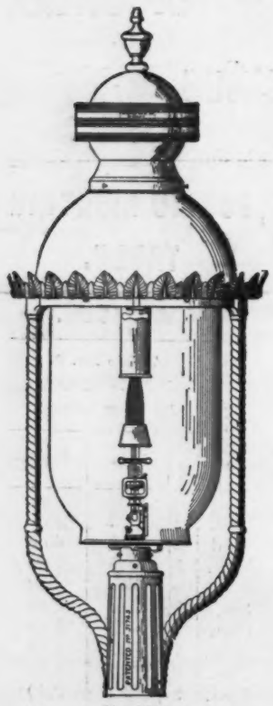
By Table No. 2.

	Hrs.Min.
January	423.20
February	355.25
March	355.35
April	298.50
May	264.50
June	234.25
July	243.45
August	280.25
September	321.15
October	374.30
November	401.40
December	433.45
Total, yr.	3987.45

NEW YORK, 318 West 42d Street. BOSTON, 820 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, 218 La Salle Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 3.

The Welsbach No. 6 Harp Fixture.

AN IDEAL LIGHT FOR DINING OR LIVING ROOMS.

THE HIGHEST MECHANICAL INGENUITY COMBINED WITH ORNAMENTAL BEAUTY--THE NEWEST OUTPUT FROM THE WELSBACH FACTORIES.

Equipped with new model No. 66 high candle power Welsbach Burner.

Side Pilot By-pass Tube covered with refractory sleeve to prevent bending.

Fourteen-inch Opal Dome Shade.

Polished Brass Embossed Crown 2¼ inches high.

Length of Fixture, 30 inches.

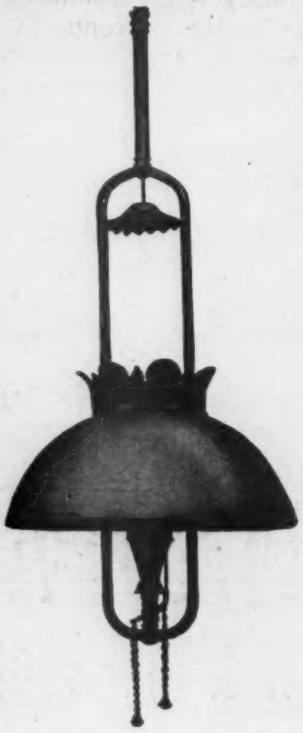
Width of Harp, 4½ inches.

Finished in Polished Brass.

Packed One Dozen to the Case.

List Price, per Dozen, $45 00.

We recommend equipping the No. 6 Harp Fixture with No. 4197 Intensive Brand Mantle, and the No. 306 **F. Q. M.** Clear Glass Air-Hole Cylinder.



Although the 14-inch Opal Dome Shade is standard equipment, we are prepared to furnish Dome Shades in green, pink or yellow (opal lined), and will be glad to quote prices.

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Lancaster, Pa.
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TOTAL SETS TO DECEMBER 31, 1905, ... 593
TOTAL DAILY CAPACITY TO DECEMBER 31, 1905, 463,780,000 CU. FT.

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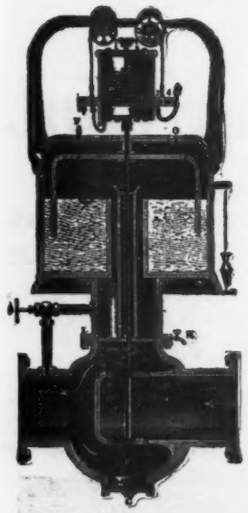

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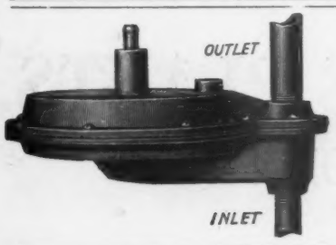

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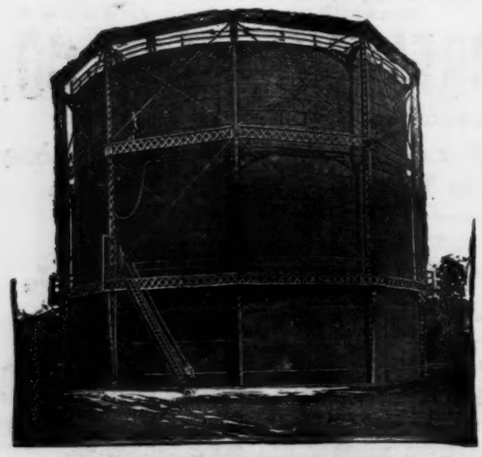

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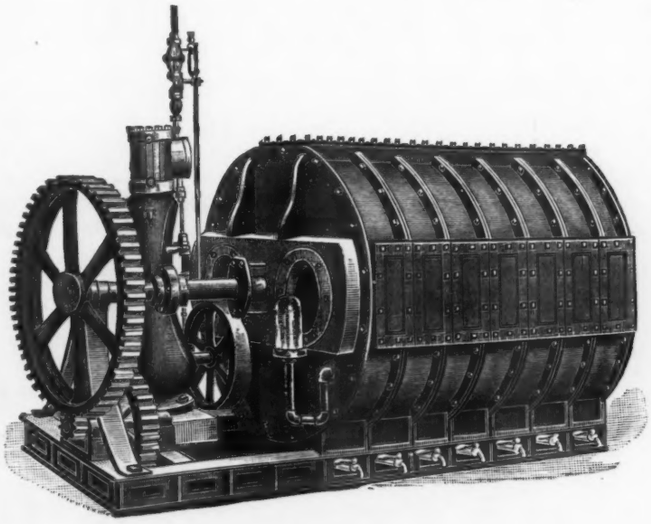

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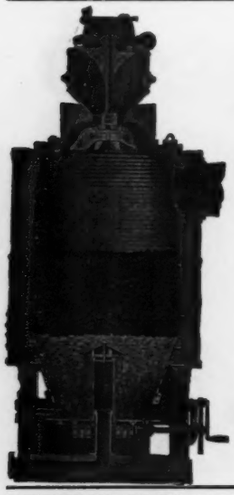

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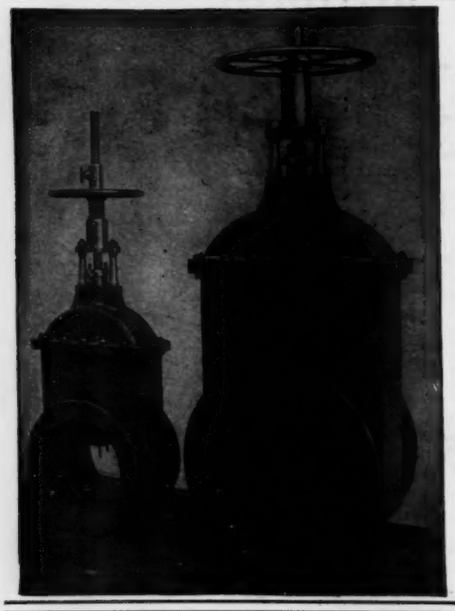

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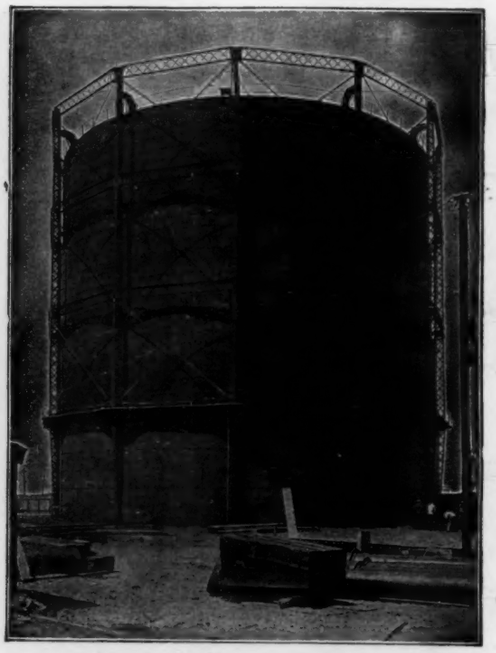

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NEW YORK, ST. LOUIS, PHILADELPHIA, SAN FRANCISCO, CHICAGO,

Wet and Dry Gas Meters, Station Meters, Meter Provers, Photometrical Apparatus, Gauges,

PREPAYMENT METERS,

REGULAR METERS REFITTED WITH PREPAYMENT ATTACHMENTS.

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FACTORY AT ERIE, PA.

EXCERPTS FROM DECISIONS

—OF THE—

BOARD OF GAS COMMISSIONERS of the COMMONWEALTH OF MASSACHUSETTS.

MR. E. H. YORKE, NEW HAVEN, CONN., Dec. 1, 1898.

Dear Sir: I am in receipt of a copy of "Excerpts from the Decisions of the Board of Gas Commissioners," which is a handy compilation in book form of extracts from the most recent decisions of the Gas Commission of Massachusetts.

I note that most of these extracts are broad and safe-guiding precepts, which apply with equal force to one Company as to another. The 13 years' existence of the Board of Gas Commissioners, with its unusual opportunities for acquiring information, have justly made it a high and safe authority in all matters pertaining to the management, obligations and rights of Gas Companies. Your little book will serve as a valuable reference library in settling legal complications which often arise between a Gas Company and its customers.

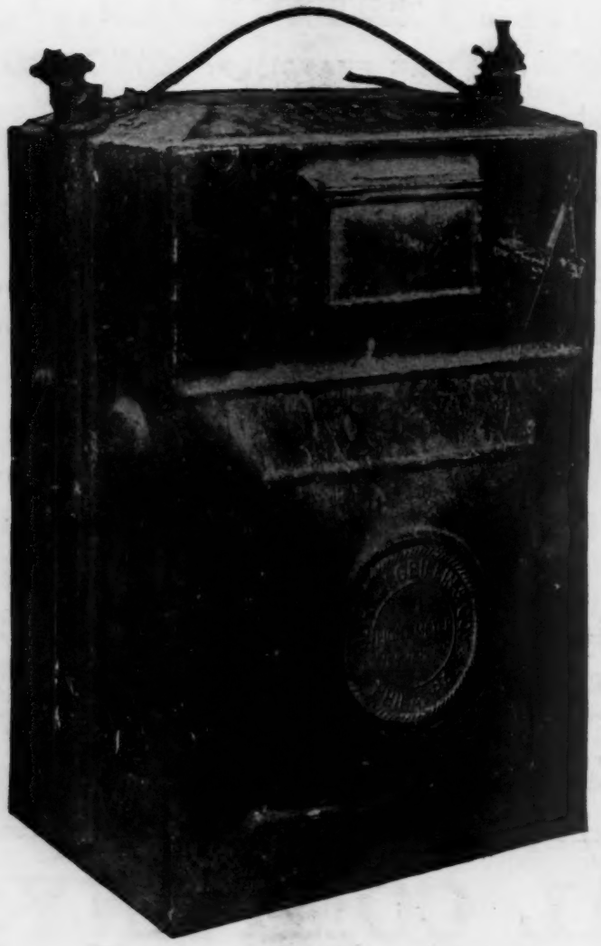
Yours truly, (Signed) F. C. SHERMAN, Superintendent.

☞ A 28-page Pamphlet, containing the cream of this Board's decisions as to the proper management of Gas Companies.

Compiled by E. H. YORKE. Price, $1.00. Address,

A. M. CALLENDER & CO., 42 PINE ST., NEW YORK CITY.

BEFORE.



This is a photograph of a 3-light regular meter out of a lot of meters received from the Coatesville Gas Co., Coatesville, Pa., to be repaired and converted into prepayment meters.

AFTER.

This is the same meter after it has been repaired and converted into a new prepayment meter.

If you have some ordinary meters to be repaired, send them to us and let us repair and convert them into prepayment meters. They will be a source of satisfaction and profit to you.

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SEND FOR OUR BOOKLET.